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Europe Report

SCIENCE AND TECHNOLOGY

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EUROPE REPORT

SCIENCE AND TECHNOLOGY

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UK SEEKS ESA PARTNERS FOR HOTOL PROJECT

Paris AFP Sciences in French 5 Jun 86 p 31

[Text] The British HOTOL space-shuttle craft project was the main topic of talks held by the Italian and British Ministers for Scientific Research, Luigi Granellu and Geoffrey Pattie.

"Italy intends to carry out an appropriate analysis on the corporate level and begin consulting with the governments participating in the European Space Agency," announced the Italian minister, pursuant to the talks. Italy, he emphasized, has already requested a new ministerial meeting of the European Space Agency.

As the third space vehicle project, in addition to the American space shuttle and the French HERMES space-shuttle craft, HOTOL is designed to be a horizontal take-off craft, capable of putting into low orbit large-size satellites or components of orbiting stations and landing on normal runways. The original design for its propulsion system is based on the use of hydrogen and oxygen from the atmosphere for propulsion.

Not included in the decisions of the European Space Conference held in Rome in January 1985, the HOTOL project was "considered to be of wide interest for the innovations it contributes and for the important technological and industrial consequences," stated a press release from the Italian Minister for Research.

Mr Pattie, who was accompanied by Mr Roy Gibson, director of the British Space Agency, stated at the end of the talks that the project was still in the "concept verification stage," in which the determination of its theoretical operational feasibility will be made.

"There is still much to be done before the industrial phase is achieved, with division of production among several countries. In technical terms, it could be operational in the year 2000," stated the British minister.

Great Britain would like to "share the project with its European ESA partners, starting with the testing phase," he added, saying that the estimated cost is 4.6 billion ECU, and, in total, 6 billion ECU including satellites launch tests.

The British minister, who had previously visited Madrid, Paris, Bonn, and the Hague, received a "positive and constructive" reception. The French, who are developing the Hermes project, he said, are receptive to the HOTOL project and "show a great deal of interest in it."

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CSO: 3698/528

BRIEFS

NEW RHONE-POULENC LAB--Rhone-Poulenc's Sante division will combine in a single IBF company (IBF Biotechnics in all countries except France) all its "Biotechnology Supply" activities. These include products and/or processes resulting in the synthesis and purification of high profit biologic substances, particularly natural and synthetic cell culture media and organic and inorganic substrates for separation techniques. These activities were previously divided among several different companies of the Rhone-Poulenc Group. IBF, whose president is Michel de Rosen, has capital of 20 million francs held by Rhone-Poulenc Sante (40 percent), Institut Merieux (40 percent), and BANEXI (20 percent). Rhone-Poulenc will invest 200 million francs in the creation of a new biotechnology research laboratory in its Health Division research center at Vitry. This new center will become operational in the second half of 1988 and will bring together 200 researchers. It will concentrate on research carried out in the areas of biology and biochemistry. Rhone-Poulenc, which has the third largest operational fermentation capacity in the world, plans to facilitate the design, refinement, and industrialization of the biochemical processes in its Health Division (veterinary and human), agrochemistry, and chemistry departments. [Text] [Paris BIO LA LETTRE DES BIOTECHNOLOGIES in French May 86 p 3]

FRG BILL AGAINST CLONING--The West German Minister for Research, Heinz Riesenhurter, announced that a legislative project is being prepared which would outlaw human cloning and the creation of animal-human hybrids. He stated that the embryo protection law would forbid the production of human embryos for research purposes as well as experiments on live aborted fetuses. In addition, prior official approval would be required for any embryo research. [Text] [Paris BIO LA LETTRE DES BIOTECHNOLOGIES in French May 86 p 3] 13146

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CSO: 3698/528

AIRBUS PRESIDENT PIERSON ON PLANS, AMERICAN COMPETITION

Hamburg DER SPIEGEL in German 5 May 86 pp 156-157, 159, 162

[Interview with Airbus President Jean Pierson at the Airbus office in Paris, by SPIEGEL editors Stephan Burgdorff and Werner Meyer-Larsen: "'We Must Offer a Family of Airplanes': A SPIEGEL Interview with Airbus President Jean Pierson About His Plans and American Competition"; date not given; first two paragraphs are boxed material]

[Text] The Airbus consortium has partners from four nations: The French Aerospatiale, Deutsche Airbus GmbH (a full subsidiary of the Messerschmitt-Boelkow-Blohm technology company), British Aerospace and the Spanish Casa. The company was founded in 1970 to create a counterbalance to the U.S. producers Boeing, McDonnell Douglas and Lockheed, which up to that time had dominated the world market for passenger aircraft. However, little has changed in the predominance of the Americans since then. Approximately 70 percent of all passenger airplanes come from the Boeing plants in Seattle. Only one in ten transport planes is an Airbus. The individual components of the Airbus airplanes are manufactured in the factories of the partner firms and then assembled in Toulouse. Since the founding of Airbus, the governments of the participating countries have invested some $10 billion in the airplane company in the form of low-interest loans. The company has yet to turn a profit. In the coming years, the owners of Airbus want to invest another $2.5 billion in new airplane models. The Airbus fleet, which thus far consists of the A300 and A310 intermediate-range airplanes as well as the A320 short-range jet, which will be available in early 1988, is to be expanded with the addition of two more airplanes: the A330 intermediate-range jet and the four-engined A340 long-range airplane. With its complete family, the Europeans are striving for a share of the world market of approximately 25 percent in the coming years.

Jean Pierson, 45, was elected as president of Airbus Industries in Toulouse last year. The brawny Frenchman, who tends to punctuate his sentences with great gestures and occasional pounding on the table, is the exact opposite of his predecessor, Bernard Lathiere. The latter embodied the stereotype of the politically experienced French elite official. In contrast, Pierson, who was previously head of transport airplane construction at the French nationalized firm Aerospatiale, is a man of practical experience. The educated engineer

speaks the language of technicians and knows the fine details of airplane construction.

SPIEGEL: Mr Pierson, the European Airbus Industries wants to adopt two new transport airplanes into its program: the two-engined A330 and the four-engined A340. Is it possible to sell a sufficient number of both models?

Pierson: The decision by our board of directors is the result of more than 2 years of intensive market research. We feel that there are essentially two areas of growth in civil aviation: on the one hand, the market of intermediate-range large-capacity aircraft, in which we are already well represented with our A300 and A310 models. The tendency is moving in the direction of making these airplanes even larger and having them fly even farther. On the other hand, we are moving towards long-range aircraft that can fly 12 or more hours without making a stopover.

SPIEGEL: What sort of distances do those airplanes cover?

Pierson: From France to Tokyo or from Hamburg to Los Angeles, for example. I am certain that demand for suitable aircraft capable of such distances, as well as of intermediate distances, will rise. This is a billion dollar market.

SPIEGEL: That seems rather optimistic to us. Other estimates assume that 400 to 500 airplanes of this type will be required throughout the entire world.

Pierson: Last fall, we surveyed a total of 34 airlines. According to this, a total of 1,300 airplanes of the series that we are planning will be required by the year 2005, thus within the next 20 years. We had ourselves counted on only 900 planes. But when our marketing experts determined a need for 1,300 planes, we said, OK, now you have to sell that number!

SPIEGEL: How many planes would you have to sell for Airbus to cover its costs?

Pierson: In our calculations we are assuming 900 airplanes, and this alone would justify investments. Of these 900, 250 to 300 are the four-engined A340 and a good 600 are the two-engined A330. However, that is a conservative estimate. I am personally convinced that we can create a new market with the A340 and sell more.

SPIEGEL: On what is your confidence based?

Pierson: Up to now, there have been no long-distance airplanes of this type. There is only the Boeing 747, and it is about twice as large as our planned A340. And yet it is ridiculous to use a jumbo in places where it can only be half filled.

SPIEGEL: Have you already found an airline that wants to order your new models?

Pierson: When we conducted our market survey last year, we wanted to first find out what the airlines need: how many seats should the planes have, what distances should they be able to put behind them, what should their highest speed be. We now know what we must have to offer.

SPIEGEL: When do you begin with the development of the new models?

Pierson: We are already working on that. At the same time, we are trying to find airlines that are willing to enter into the project. Based on our projections, we could then conclude the design phase around the end of this year and begin construction.

SPIEGEL: And when can you deliver the airplanes?

Pierson: Our plans allow for the first deliveries of the A340 in the fall of 1991 and the first A330s in early 1992. This would mean that the A340 would make its first flights in the fall of 1990. Before an airplane is allowed, it must undergo tests for approximately one year.

SPIEGEL: Do you in fact know what sort of airplanes your competition will be offering at the beginning of the 1990s?

Pierson: Our plans are essentially based on two assumptions. We assume that the U.S. producer McDonnell Douglas will bring the MD-11, the successor to the DC-10, onto the market. We have also given thought to everything that the Boeing people might be doing in the coming years.

SPIEGEL: Have you reached a conclusion?

Pierson: Our engineers have in particular conducted research on how Boeing could further develop and improve its 767 and its 747. For example, the Americans could make the jumbo lighter or more economical in fuel use.

SPIEGEL: What have your engineers found out?

Pierson: They have found out that an airplane as large as the 747 can never fly as economically as the A340 that we are planning.

SPIEGEL: Did you take into consideration the fact that the Boeing aircraft will one day be equipped with new propfan engines, thus with jet-driven propellers?

Pierson: No. There is still no serious data about this technology. It may come about some day, but no one knows for sure when. It is entirely impossible to predict today what an airplane with propfan engines will look like and at what price it could be put into use.

SPIEGEL: The Boeing plants have announced that they will put propfan aircraft on the market in the mid-1990s.

Pierson: Boeing has already announced these engines for 1992. We believe that it will take longer.

SPIEGEL: That would still be early enough to create difficulties for Airbus.

Pierson: We want to see it first. Naturally we are keeping a very close watch on developments in this area. That is our job. We doubt that the issues of economic feasibility, safety and noise protection will be solved by 1992. If these problems are solved, then we will be able to use this technology as well.

SPIEGEL: Is it then possible to equip airplanes with standard engines or with propfans at will?

Pierson: Boeing is intending to do just that with the 747. The company is not saying that it is going to alter the 747. It is saying that it will offer the jumbo in 1995 with propfan engines. If Boeing can do that with the 747, why should we not be able to do it with our much more modern airplanes?

SPIEGEL: It seems to us that the financing of the new aircraft is much more difficult that their construction. How much money do you need for the development and construction of the planes, and where will you get it?

Pierson: Our starting figure for the two basic models in June of last year was $2.5 billion.

SPIEGEL: $2.5 billion up to the beginning of production?

Pierson: Yes, for development up to the beginning of production. Of course, it is no simple matter to raise this sum of money. But it is obvious that all the Airbus partners will be involved. Each one must ask himself how much he can make available from his own resources and how much he will have to obtain from outside sources.

SPIEGEL: The governments of the firms involved in Airbus have already invested a great deal of money in Airbus Industries. Are you still counting on low-interest state credits?

Pierson: Yes, and there are good reasons for this. After the war, transport aircraft was really only built in Great Britain and France. Then it turned out that national aircraft producers did not stand a chance against the predominance of the Americans.

SPIEGEL: Because the U.S. producers have a larger home market?

Pierson: That is the most important premise. But the Americans also did the right thing: While the English and the French were concentrating on the Concorde supersonic airplane, Boeing developed a jet aircraft under commission to the U.S. Air Force. That was the birth of the 707...

SPIEGEL: ... the first long-range transport aircraft in the world with jet propulsion to be built in large numbers.

Pierson: Yes. Thus began the jet age, and the Europeans were definitely far behind. Boeing built up a complete family of airplanes. The 707 was followed by the 727, then the 737 and the 747, and finally the 767 and the 757. No other producer in the world can offer such a range of products. That is what sends money to Boeing. They sell not airplanes, but rather a fleet.

SPIEGEL: How does Airbus want to fight this?

Pierson: We have to similarly offer a complete family of airplanes. If we do not do this, we will not be able to survive on the world market in the long run. In that case there would have been no reason for us to even start.

SPIEGEL: Why do the Europeans have to produce airplanes anyway? Are there not more meaningful things to do?

Pierson: You sound like a Boeing manager. One of them said recently, "Do the Europeans have to themselves produce everything that they consume? After all, the Americans don't build trains, but they do use them."

I view this differently. This is not a matter of shoes or clothing. It is a matter of high-grade technology. The airplane industry sends stimuli out to all other branches of industry. We should not and cannot renounce this, even if it requires some effort.

SPIEGEL: Should the governments continue to pump billions of dollars into Airbus Industries for this reason?

Pierson: This is not a matter of subsidies, but rather of repayable loans.

SPIEGEL: Which is nearly the same thing. The credits are, after all, only repaid when Airbus Industries turns a profit.

Pierson: I admit that the expenditures for the Airbus project are large. But I assure you that the investments that are now necessary are the last ones until the year 2000. They are necessary to complete the family of airplanes. Without these investments, all previous efforts would have been in vain.

SPIEGEL: Why does Airbus not seek new, strong partners in order to minimize the financial risk?

Pierson: That is easier said than done. Just look at the problems that we face in developing the A330 and the A340. The most important problems are aerodynamics and flight quality. We cannot entrust this to others. This is engineering work that we must carry out in our own construction offices. The same is true for flight testing and technical authorization.

SPEIGEL: Yet it must be possible, during production at the latest, to cooperate with others.

Pierson: We are engaged in talks with several firms about that. But even in production it is not as simple as you perhaps think. The duties that we could transfer over to other partners constitute at best half of the total volume of

work. If we delegate about 20 percent of these activities to others, that would be a total of only 10 percent of the overall investment.

SPIEGEL: Why can Airbus not do the same as Boeing? Boeing wants to build a new airplane with the Swedish aircraft producer Saab-Scania and the Japanese.

Pierson: We cannot entrust 40 percent of our work to the Swedes and the Japanese because we must first make full use of our own factories. I also do not believe that other nations would be willing to invest all of their money in Airbus Industries.

SPIEGEL: Is Airbus not threatening to fall dangerously behind because of the cooperation between Boeing and the Japanese in Asia? Especially in Asia, a growth market, it will be decided by who sells the most airplanes.

Pierson: Our position in Asia is very good. At the moment we only offer two airplanes, the A300 and the A310. Naturally, they cannot be compared with the short-range Boeing 737 jet, and certainly not with the jumbo. The model competing with our two models is the Boeing 767. And compared to this airplane, we have an 80 percent share of the market.

SPIEGEL: The Americans claim that Airbus has achieved its successes in Asia through dumping.

Pierson: That is an outright lie.

SPEIGEL: Is it?

Pierson: I know the competition's prices. They are lower than ours.

SPIEGEL: Boeing is thus getting subsidies as well?

Pierson: Of course. Just look at how much tax Boeing is paying, and compare that to the amounts that our member-firms Deutsche Airbus, Aerospatiale and British Aerospace are paying to their governments. That will open your eyes.

SPIEGEL: Can you give concrete figures?

Pierson: I can only tell you what an American taxpayers organization wrote about Boeing last fall: Boeing is the worst taxpayer in the work. Boeing's response was: That is true, but at least we provide jobs.

SPIEGEL: The Americans maintain that there were improper secondary agreements involved in the sale of Airbuses to Indian Airlines. The French government reportedly promised the Indians political support, assistance in cleaning up the Ganges and arms supplies.

Pierson: I can assure you that we only negotiated with the managers of Indian Airlines. And that, in fact, was not easy. We sent a large group of engineers and sales personnel to India. We presented numerous calculations about costs and return, about fuel prices and capacity, etc., etc. At the end

of these talks, which lasted months, the Indians were convinced that our airplane was the better solution for them.

SPIEGEL: And the Indians were convinced without any further concessions?

Pierson: The Indians did not at any rate get any of those things that were allegedly promised them. Anyone can check that out. Moreover, if the French government did in fact exert pressure, then please explain to me why the Indians ordered those very engines in which the French are not at all involved. You can see what nonsense all this is.

SPIEGEL: Is it then also not the case that Airbus is giving the Indians the airplanes free of cost for a certain period of time?

Pierson: That is part of the agreement. If the deal as a whole had not made sense to us, we certainly would have rejected it. Anyway, Boeing does the exact same thing.

SPIEGEL: You also concluded a spectacular deal with Pan Am. Did you make anything from that?

Pierson: We receive money from Pan Am every month.

SPIEGEL: For how much longer?

Pierson: That is the problem with the Pan Am deal. It is naturally easier to supply aircraft to airlines that are doing well financially.

SPIEGEL: Nevertheless, you recently sold six airplanes to the U.S. company, Continental. Is that the extent of it, or will there be more?

Pierson: There will certainly be more. I don't know how many, but a couple of weeks ago, Continental's chief, Frank Lorenzo, was here to clear up a couple of conditions.

SPIEGEL: When will Airbus begin earning money with its airplanes?

Pierson: That is not an easy question to answer. The first airplane that we built has in the meantime changed radically. There we were unable to reach the profit threshold. But in general it can be said that for this type of airplane the break-even point, at which we have recovered our costs, is around 400 to 500 units. That is incidentally also the case in the United States.

SPIEGEL: So it will be a while yet before Airbus turns a profit.

Pierson: It is not so much a matter of when we have a profit. What is important is that the individual partner firms earn something from Airbus production. Even more important is that we are able to survive amidst competition, because the airplane industry is part of the technological future and thus part of Europe's future.

SPIEGEL: Mr Pierson, we thank you for this interview.

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GOVERNMENT AID REFUSAL SEEN THREAT TO SWEDISH AIRCRAFT INDUSTRY

Stockholm DAGENS NYHETER in Swedish 14 Jun 86 p 11

[Article by Goran Jonsson: "Government Says 'No'"]

[Text] The government refuses to provide financial aid to Saab-Scania and Volvo's future civilian aircraft-engine project.

"We are not willing to share the risk associated with the civilian aircraft project," said Department of Industry Undersecretary Jan Carling.

"Government policy with respect to industry is that industrial projects must be self-sustaining. I cannot imagine that the government would deviate from this policy," Carling continued.

Inasmuch as military orders are declining, Volvo Aircraft Engine and Saab Scania are trying to restructure their activity to allow for more civilian production. Saab expects that the civilian portion of its production this year will reach 50 percent for the first time. Volvo lies somewhat behind with a civilian production of 40 percent plus.

A Gap

At the same time, there will be a gap in military orders because the Viggen project will be suspended in 1988 until the first JAS aircraft is ready to roll in the early nineties. This gap will have to be filled by an increased share of civilian production.

"If the government says "no," the situation would be serious for the aircraft industry," said Bengt Eriksson, incoming deputy director of Volvo Aircraft Engine.

"I do not want to make this an employment issue, but thousands of people would be involved in the changeover from military to civilian production. Our production has been designed to supply the military with planes and engines. Since the military is now cutting back on its orders, we will not be able to restructure

to allow for increased civilian production without financial aid from the State in terms of financing," said Eriksson.

Volvo and Saab both feel that this is not a question of government aid in the usual sense. The aircraft industry is an advanced high-technology industry and both firms are healthy and profitable. Furthermore, it is necessary to maintain production so as not to lose technical competence, which would have serious consequences for future military production.

Natural

This makes their situation completely different from that of the textile industry, for example. It is only natural that the government provide financial aid to the aircraft project, according to Volvo's Eriksson. It has always been this way.

"All countries interested in developing their aircraft industry provide financing of this kind. This is not unique to Sweden. It is quite simply a matter of the industry's circumstances. Projects of this kind require such enormous investments that no firm can do it alone," said Bengt Eriksson.

In a project like this, Saab and/or Volvo become the partners/suppliers of a larger aircraft manufacturer like Boeing or McDonnel Douglas, for example.

The cost of financing the project is very high and so are the risks. Therefore, the companies in question want the State to assume part of the risk. In return, the state will get x percent of the profits when and if the project becomes profitable.

"The profits do not equal the high risk. These firms will have to turn to the Industry Fund for help," said Carling with the Department of Industry.

Not Enough

The Industry Fund's loan ceiling has been raised to 50 million kronor, which is not enough in this case. However, even if Saab and Volvo have need of more than this, their requirement is far less than the 2 billion which the mass media are talking about. All the parties involved absolutely repudiate this figure.

"For a time, the total amount for Volvo and Saab combined was 700 million kronor, but the figure is exaggerated. Our discussions last spring concerned a lesser amount," said Carling with the Department of Industry, which together with the Departments of Defense and Communications will determine the future of Sweden's aircraft industry.

However, despite its awareness of declining military production, the government does not want to financially aid any of the projects submitted by Volvo and Saab.

Among Volvo Aircraft Engine's projects is a stationary gas turbine engine for General Electric.

Cooperative Venture

Saab Scania together with three other aircraft companies in Norway and Denmark recently formed the Scandinavian Aircraft Group (SAG), a cooperative venture to enhance their position with respect to the international market.

Saab's future projects include the Fokker 100, a new intermediate-range aircraft (an SAS alternative when it comes time to replace its entire fleet of intermediate-range aircraft), and the MD11, an advanced version of the DC10, which will essentially be longer range. The idea is that Saab shall manufacture the tail section of the MD11.

Saab is also supposed to help design Boeing's new intermediate-range aircraft, the 7J7, an advanced aircraft with a so-called prop-fan engine, i.e. jet engine with propellers, very simply expressed.

Saab-Scania Deputy Director Georg Karnsund said he had no comment whatsoever.

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CSO: 3650/246

BRIEFS

PHILIPS, SIEMENS, THOMSON CHIP PLANS--Eindhoven, 11 Jun--Dutch and West German electronics giants Philips and Siemens plan to launch a joint project in 1989 with the French Thomson electronics concern to develop a 64-megabit microchip, Philips said today. Philips and Siemens are at present developing a one megabit chip, scheduled to go into mass production by 1988, to be followed by a new generation of four megabit chips to compete with Japan and the United States in computers and high technology products. Philips said the proposed joint venture with Thomson would take place within the framework of the Eureka-programme and would be discussed at a conference of European Community (EC) ministers in London in late June. The Dutch electronics multinational said the development of the one- and four-megabit chips was of utmost importance in gaining technological know-how needed to manufacture the ambitious 64-megabit chip. A Philips spokesman explained that circuits on the 64-megabit chip would need to be reduced even further and due to the complex nature of such a process the help was needed of a third micro-electronics manufacturer. [Text] [The Hague ANP NEWS BULLETIN in English 12 Jun 86 pp 2-3] /9274

CSO: 3698/559

FRENCH PRESS COMMENTS REVEAL IMPACT OF RESEARCH BUDGET CUTS

Billions of Francs Cut

Paris LE MONDE in French 28 May 86 p 18

[Article by Jean-Pierre Chavenement, former minister of research and industry]

[Text] In the directives recently issued to his ministers on preparing the 1987 budget, Mr Jacques Chirac indicated that budgeting "must necessarily adhere to the principle of reduced government involvement." His avowed intent is to "favor stronger, healthier growth to promote job creation."

The idea has been rehashed a hundred times: By reducing the burden of the well-known "required withholding taxes," enterprises would be given maximum control over the allocation of their resources. The best performers would thus be given their chance. Although it cannot be said that there is not an ounce of truth in this very broad idea, it is easy to demonstrate that the liberal philosophy underpinning the decision of the current government is simplistic and therefore in error. In fact, world competition today pits not only businesses but, more fundamentally, entire economic and social systems against each other. The case of research is a particularly good example of this because research plays a decisive role in all modern economies and, increasingly, it determines the winner.

French research has just been dealt a rude blow: For the first time since 1981, research allocations in 1986 have decreased relative to the previous year (by approximately 4 percent, as opposed to a projected increase of 4 percent in volume). The allocations cancelled by the decree of 17 April 1986 primarily affect the research budget (half relate to program authorizations, nearly a third concern payment allocations, for a total of 2.2 billion francs out of a total of 6 billion francs in cancelled funding).

Enterprises Need the State

This is an unfortunate decision. The national research effort, which stagnated at 1.8 percent of the gross domestic product throughout the 1970s, grew continuously for 5 years, up to 2.29 percent of GDP in 1985 (Footnote 1) (Report on the state of technological research and development appended to

the 1986 budget law) that is, the highest level ever attained in France (the previous record dated from the de Gaulle era: 2.16 percent in 1967 vs. 1.15 percent in 1969). This recovery effort--which still left us trailing behind the United States (2.73 percent in 1983), Japan (2.55 percent), and the Federal Republic of Germany (2.57 percent)--in itself constitued a policy (Footnote 1) (Report on the state of technological research and development appended to the 1986 budget law) deliberately pursued for 5 years by Francois Miterrand, despite his "severity." This policy has just been shot down.

The following quotation is attributed to former president Pompidou: "There are three ways to lose money: The most pleasurable is women, the quickest is gambling, the most certain is research." Using the example of research, political commentators are justified in speaking of a "return to the Pompidou era." In fact, the same men today are making the same short-sighted decisions that they made in the early 1970's, guided by the purely monetary concerns of budget management. Those who presided over the historic decline of French research have returned.

Enterprises need the state. Only the government can support the high-level fundamental research which is a precondition not only for future progress in applied research but also--and more prosaically--for introdusing progress achieved elsewhere into our country.

Research in France--and, regrettably, this is a situation which cannot be changed overnight--was able to develop only with the help of the government: The state provides 55 percent of funding for civilian research vs. 40 percent in Germany, 37 percent in Japan and 34 percent in the United States (Footnote 1) (Report on the state of technological research and development appended to the 1986 budget law).

In industrial research, (approximately 50 billion francs per year) France lags far behind the United States (416 billion), Japan (111 billion), and Germany (81 billion), despite its efforts to recover: Expenditures on research performed within enterprises relative to gross production in industry thus rose from 1.11 percent in 1980 to 1.26 percent in 1984. The growth of the research effort of national enterprises (5 percent per year in volume) has been particularly remarkable since 1982.

However, this attempt to recover can succeed only with the help of the state which contributes 22 percent to industrial research funding, or 12 billion francs per year. The historic lag of our industrial research and the small number of French enterprises which are developing a research policy (only 1,300 enterprises employ more than one full-time researcher and 100 companies employ more than 50!)--all of this makes state intervention an absolute imperative. But paradoxically, it is precisely those funds allocated to technological and industrial research (to ANVAR and the Fund for Research and Technology) which are the major targets.

The rude blow dealt to the long term industrial and technological policy designed in 1981 is severe. In order to bear fruit, this type of policy needs a long time (General de Gaulle's policy was implemented over 10

successive years [1958-1968]). The effort initiated at the beginning of Francois Miterrand's 7 year term has been halted in midstream.

It is not to early to issue such an unqualified judgement? No! It is enough to observe the relationship between cancelled payment allocations and program authorizations: respectively, 200 million francs and 400 million francs for ANVAR, and 100 million francs and 5.35 million francs for the Fund for Research and Technology. This steep slope bodes ill for the 1987 budget! Mr Alain Devaquet--who bravely defended the CNRS and the INSERM against the UNI extremists--will be powerless in the face of Mr Chirac's budget directives. If he decides to be more generous in the fall, it will be toward his clientele rather than toward research. Similarly, the elimination of the Ministry of Research and Technology that I created in 1981 will in the end deprive France of the "ministry for the future" which Francois Miterrand explicity wanted for the country.

I am not criticizing in principle the union of research and higher education. It may be welcome one day. But today, it forebodes a dangerous step backward: The policy of bringing research together with industry that was implemented following the colloquium on research and technology (1982) has not yet had time to produce all of the results that can be expected--whether in terms of development of research in large organizations authorized to create "public interest groups" and subsidiaries, or the movement of researchers into enterprises, or even creation of regional technological poles combining industry and higher education.

Research has an overly pronounced tendency to turn inward, to isolate itself in solitary splendor in an ivory tower. Uniting research and higher education thus creates a very great danger of "academic regression"; it reflects the narrow and nearly reactionary ideas of a few sovereigns who have successfully imposed these views for purely ideological reasons in order to impede the trend toward the association of research and industry which the Left explicity wanted.

The end of the Ministry of Research and Technology deprives research of the powerful advocate within the government which it needs to obtain respect for its priority position in the government budget. Dispersion of the supervisory authorities and the scattering of funding among a large number of ministries will prevent implementation through a cohesive civilian research and development of research programs that transcend organizational boundaries. The end of the MRT signals a victory for the rue de Rivolu establishment. Only a strong "ministry of the future" with freedom of movement can provide sufficient impetus to overcome the two conservative forces with their overriding influence in the world of academics and in the labor unions.

On the Road to Underdevelopment.

For several years, it has been fashionable to stigmatize "Colbert's philosophy". I have always believed that trend evidenced a failure to understand France. Development of high-level research and the great technological breakthroughs (the atom, aviation, space, electronics) were made in France (and even elsewhere) only by the government. On the breakthroughs are achieved, the

problem is their transfer toward enterprises. This transfer must organize itself.

Yet, things seem to occur as if, by becoming entrenched in a state of opposition against the government, the leaders of the Right today has simply placed the means for the national recovery into the hands of a labor union system which they know is not prepared to pick up the thread if left to its own devices.

The return of the conservatives also signals the return of the conservative establishments in research as in industry. It creates the problem of knowing whether France is capable--or not--of taking the "intelligent step"--in short, of conducting the continuous effort in terms of intellectual, scientific and technological investments which is precondition for the nation's survival. The choices that have been made in less than 60 days are enough to show that if the return of the conservative establishment is a long term trend, France will find itself on the road to underdevelopment. In the battlefield of the world economy, reduced government involvement in research is tantamount to unilateral disarmament!

Effect on Scientific Community

Paris LE MONDE in French 29 Apr 86 p 13

[Article by Jean-Francois Augereau]

[Text] The austerity measures that have recently dealt a blow to research activities have been cause for anxiety within the scientific community. Researchers of all disciplines and political tendencies have protested against these arbitrary cuts to their budgets; these protests are echoed by labor unions which, for the most part, deplore "this unprecedented attack." According to one of these organizations: "The effort to recover initiated several years ago" has been "brutally" interrupted, which is likely to hinder the launching of "programs which are indispensable to the country's progress and to the modernization of the economy."

For its part, the Higher Council on Research and Technology (CSRT), a consultative body working for the minister in charge of research on the major decisions of the government's scientific policy, has just submitted a "specific, well-argumented analysis on the present and future consequences of the cancellations" to Mr Alain Devaquet who will forward it to the prime minister. The CSRT's position is not meant to be controversial. It is nevertheless very firm. According to its vice president, Mr Francois Kourilsky, the CSRT is not contesting the fact that in a period of austerity, research, like other sectors, is dutybound to tighten its belt in the national effort. But he notes that there is a "traditional tendency" to cut deeply into his budget using the pretext that it is "an investment which is not immediately productive." This time, 54 percent of program authorization cancellations (Footnote 1) (Program authorizations allow for contracting of research activities for the years to come, while payment allocations concern the current year.) for all of the ministries combined affect research.

Certainly, recalls Mr Kourilsky, research was subjected to similar measures in 1983 and 1984. But these cancellations had left "a budget with a growth of 8 percent in volume relative to the preceding year." Today, the situation is somewhat different since instead of "a projected increase of 4 percent in volume of the 1986 civilian budget for research, there was a 4 percent decrease!"

Can it be concluded that Mt Chirac's government has veered 180 degrees with respect to the policy of his predecessors? According to Mr Kourilsky, "it would be premature to affirm this." In fact, it must be acknowledged that "these cancellations occurred in an emergency context, while the ministers concerned were not certain of their allocations." He adds: "It is therefore clear that these cuts were engineered by the ministry of economy and finance." Just like in 1984. Which led the vicepresident of the CSRT to comment that "although the 'highly competent' finance functionaries follow through on their ideas, they do not have any special ability to evaluate the content of research."

Reversed Priorities

In fact, notes the CSRT, "although the situation is relatively difficult, it is not disastrous." Although it is clear that cancellation of payment allocations will create significant accounting problems for certain organizations, the cuts in program authorizations are cause for greater concern. First of all, because these measures lead to "an upset, even a reversal of certain priorities that have been long thought out and recommended by the planning commission and by the higher council for research and technology." Second, because this is a preview of what is in store for budgets devoted to research in 1987 and 1988.

Thus, the development of industrial research in traditional areas that are important for the economy (agriculture and food, textiles, building, materials, etc.) is affected by these measures because it was partially financed by incentive credits which have now been considerably reduced. Witness the reductions imposed on the national agency for the development of research (40 percent), the French agency for energy control (30 percent) and the Research fund (40 percent).

In addition to this, "Fundamental research is more specifically affected because program authorization cancellations primarily concern public establishments of a scientific and technical nature such as the CNRS, the INSERM and the INRA. Conversely, those agencies with a more industrial and business oriented character such as the CEA and the CNES are not affected. Thus, the disequilibrium in the French research effort in favor of major programs (nuclear, space and aeronautics), already emphasized by the CSRT, the OECD report on innovation in France and the report authored by Mr Jean-Jacques Salomon (LE MONDE, 18 December 1985), is further accentuated.

The outlook is not completely somber. Economies in ordinary expenditures, as important as they may be, seem to have been made "with a certain discrimination" which "does not seem to implicate the creation of jobs in

research." But, Mr Kourilsky notes, it will be necessary to await the 1987 budget and the government's orientation in order to evaluate its policy in this sector. "We are wondering whether it will take into account all or only part of the priorities defined in the 3-year plan (1986-1988) for research. It will have to decide."

But Mr Kourilsky does not believe that, on the basis of these cancellations, it would be "pertinent" to make a final judgment on French research policy. However, the CSRT has declared that it is "ready to evaluate the government's research policy during the discussions on the next budget" and has therefore scheduled a meeting for this analysis at the end of June. This meeting is eagerly anticipated by the research community and foreign observers alike, since France has in the past shown a great will to work in the field of research.

12798/12951
CSO: 3698/543

RESEARCH PROJECTS GRANTED SUBSIDIES BY ITALIAN S&T MINISTER

[Editorial Report] Rome GAZZETTA UFFICIALE DELLE REPUBBLICA ITALIANA in Italian on 10 January 1986 publishes a resolution adopted by the minister for scientific and technological research concerning the admission of research projects to the Special Fund for Applied Research. The following are selected records from this document which identify the companies admitted to the fund, fields of research, and the terms of financing for government sponsorship:

GETTI SPECIALI S.P.A. -- Borgaretto (Turin) (large firm classification).
Place of research: Northern Italy.
Object of research: "Development of innovative processes for forming and casting molds for aeronautical use."
Form of financing: Credit available at the annual rate of interest provided by decree of the minister of the treasury.
Maximum amount: Credit available: 1.264 billion lire, not exceeding in any case 70 percent of the allowed costs.
Duration: Eight years' amortization plus the period of research which must not exceed the term of 4 years and 6 months.
Amortization: Sixteen semi-annual, constant, and deferred installments inclusive of capital and interests, starting from not later than the second semi-annual expiration date following the actual ending date of the research.
Starting date of research: January 1, 1985.

GETTI SPECIALI S.P.A.-- Borgaretto (Turin) (large firm classification).
Place of research: Northern Italy.
Object of research: "Innovation in alloy metallurgy and thermic treatments for casts for aeronautical use."
Form of financing: Credit available at the annual rate of interest provided by decree of the minister of the treasury; contribution to the cost.
Maximum amount: Credit available: 680 million lire, not exceeding in any case 35 percent of the allowed coasts; contribution to the cost: 680 million lire, not exceeding in any case 35 percent of the allowed costs.
Duration: Eight year amortization plus the period of research which must not exceed the term of 4 years and 6 months.
Amortization: Sixteen semi-annual, constant and deferred installments inclusive of capital and interests, starting from not later than the second semi-annual

expiration date following the actual ending date of the research.
Starting date of research: January 1, 1985.

ITALTEL SIT S.P.A.-- Milan (large firm classification).
Place of research: Southern Italy.
Object of research: "New avionic identification system."
Form of financing: Credit available at the annual rate of interest provided by decree of the minister of the treasury.
Maximum amount: Credit available: 2.839 billion lire, not exceeding in any case 80 percent of the allowed costs.
Duration: Eight years' amortization plus the period of research which must not exceed the term of 4 years.
Amortization: Sixteen semi-annual, constant, and deferred installments inclusive of capital and interests, starting from not later than the second semi-annual expiration date following the actual ending date of the research.
Starting date of research: January 1, 1985.

ITALTEL SIT S.P.A.-- Milan (large firm classification).
Place of research: Southern Italy.
Object of research: "Uninterrupted medium and high power energy systems for telecommunications systems."
Form of financing: Credit available at the annual rate of interest provided by decree of the minister of the treasury; contribution to the cost.
Maximum amount: Credit available: 2.808 billion lire, not exceeding in any case 40 percent of the allowed costs; contribution to the cost: 2.808 billion lire, not exceeding in any case 40 percent of the allowed costs.
Duration: Eight years' amortization plus the period of research which must not exceed the term of 5 years.
Amortization: Sixteen semi-annual, constant, and deferred installments inclusive of capital and interests, starting from not later than the second semi-annual expiration date following the actual ending date of the research.
Starting date of research: January 1, 1985.

NUOVA FULGORCAVI S.P.A.-- Latina (large firm classification).
Place of research: Southern Italy.
Object of research: "Fiber optics cables."

Form of financing: Credit available at the annual rate of interest provided by decree of the minister of the treasury; contribution to the cost.
Maximum amount: Credit available: 288 million lire, not exceeding in any case 40 percent of the allowed costs; contribution to the cost: 288 million lire, not exceeding in any case 40 percent of the allowed costs.
Duration: Seven years' amortization plus the period of research which must not exceed the term of 3 years and 6 months.
Amortization: Fourteen semi-annual, constant, and deferred installments inclusive of capital and interests, starting from not later than the second semi-annual expiration date following the actual ending date of the research.
Starting date of research: September 1, 1984.

TELETTRA-TELEFONIA ELETTRONICA E RADIO S.P.A.-- Milan (large firm classification).
Place of research: Northern Italy.
Object of research: "Auxiliary telecommunications systems."
Form of financing: Credit available at the annual rate of interest provided by decree of the minister of the treasury; contribution to the cost.
Maximum amount: Credit available: 1,251 billion lire, not exceeding in any case 35 percent of the allowed costs; contribution to the cost: 1,251 billion lire, not exceeding in any case 35 percent of the allowed costs.
Duration: Eight years' amortization plus the period of research which must not exceed the term of 6 years.
Amortization: Sixteen semi-annual, constant, and deferred installments inclusive of capital and interests, starting from not later than the second semi-annual expiration date following the actual ending date of the research.
Starting date of research: January 1, 1983.

8610
CSO: 3698/M162

POLISH EC 1034 COMPUTER USED IN CSSR

Prague SVET HOSPODARSTVI in Czech No 44, 15 Apr 86 p 2

[Article by Lubomira Cizova: "Modern Computer Equipment of Polish Manufacture"]

[Text] In the computer center of the Most SHD [North Bohemian Lignite Mines] concern, there was a celebration on 24 March marking the beginning of operations of a new room equipped with modern EC 1034-type computer equipment. This third-and-a-half-generation computer is the first utility equipment of its type put into operation in Czechoslovakia. The computer was manufactured in the Elwro Wroclav enterprise in the Polish People's Republic and the official start of operations was attended by the trade attache of the Polish embassy in the CSSR, K. Kolczynska, and the general manager of the Elwro Wroclav enterprise, Eng A. Musielak, in addition to the trade manager of the Most SHD concern Eng Karel Dlask.

The computer center in Most, which is a special purpose organization of the SHD concern, was thus on the opening day of the 18th CPCZ Congress equipped with the most modern equipment of this type which is available to us. The SHD employees and the Polish specialists thus succeeded in fulfilling the obligation which they took on in honor of the Congress, to complete installation of the entire complex of equipment in half the time (instead of 4 months). We should add that experts from the Office Machines national enterprise also took part in the installation work.

Why should it be computer equipment of Polish manufacture? Certainly not just because Most is close to Poland. And also not just because the people in Most traditionally maintain good relations with their Polish collegues. The reason is primarily because Polish computer equipment has a good reputation in the CEMA countries. In addition, in Most they have been working up until now with Polish Odra 1305 model computers. Now the individual subject entities will gradually be transferred over to the new equipment, while the computer center is to be provided with a second computer of the same type by the end of this year.

In choosing the Polish supplier of the new computer equipment, it helped that since 1 January 1986 there has been an EC 1032 computer in operations in Teplice. Poland also produces, according to our experts, an excellent

telecommunications processor for an interactive system of local or remote terminals. These terminals will gradually be installed in the individual organizational units of the SHD concern. By the end of this year construction is supposed to be completed on an entirely new computer center in Most-Velebudice which will be equipped in accordance with the strictest scientific and technical requirements.

On the occasion of the official start of operation of the computer, the trade manager of the Most SHD concern, Eng K. Dlask, emphasized that the concern is one of the most important elements of the Czechoslovak fuel and energy complex and makes an important contribution to continuously supplying the Czechoslovak national economy with brown coal. He noted that the concern fulfilled and exceeded all production and economic goals for 1985 and the entire Seventh 5-Year Plan. Continuously achieving high levels of extraction under increasingly difficult conditions and providing the necessary return for intensification actions and higher efficiency in extraction require, among other things, a systematic improvement in the management system and accelerated application of scientific and technical information in the actual operations of the concern. Computers play an important role in this and their applications in managing the concern have a long tradition. For 15 years the Most SHD concern has been cooperating in this field with the leading enterprise in Poland, Elwro Wroclav. Putting the EC 1034 computer into operation is also a result of this cooperation. This completed the first stage of cooperation. But now, according to trade manager K. Dlask, there are other and more demanding tasks before use, which are fully utilizing the capabilities of the new computer and connecting it into the management system of the overall concern.

The EC 1034 computer testifies to the maturity of the Polish electronics industry and concentrates the latest information from research and development in itself. Putting it into operation is proof of the fruitful cooperation of the two socialist countries.

6285/9190
CSO: 2402/17

BULGARIAN SOFTWARE PRODUCTION SURVEYED

Bulgarian Software Industry

Sofia TEKHNICHESKO DELO in Bulgarian 17 May 86 pp 1, 4

[Article by Veselin Spiridonov, deputy director of Interprograma, head of the Software Section, Scientific and Technical Union Central Council Automation Committee]

[Text] Can we claim that a software industry exist in Bulgaria? The specialists agree: such an industry does exist. Economic and legal the grounds of the software industry were included in Directive No 8 of the former State Committee for Science and Technical Progress, published in DURZHAVEN VESTNIK No 75, 1983. This directive, which was the first to regulate software as a commodity and to clarify interrelationships, rights and obligations of customers and programmers, remains relevant. It successfully solves the problem of software ownership rights and the procedure for its dissemination. On the one hand, it helps to extend the copyright from the customer (who is also the owner of the software) to a third organization (the distributor); on the other, it forbids consumers to share a program product with or without charge with other organizations, subunits or individuals. It is thus that for the first time in our country programs were given the right to be considered products enjoying proper economic and legal protection.

On 4 July 1984 the Council of Ministers passed Decree No 34 "On the Development of the Program Industry in the Bulgarian People's Republic." This decree made the production of software an autonomous material production subsector and laid the foundations for its legal structure.

What is software? It includes the text of programs (in a given programming language), recorded on a magnetic carrier (diskette or magnetic tape), as well as the documentation governing its use, consisting of one or several volumes, or else recorded on a magnetic carrier. The software product must be repeatedly tested before offering it to the consumers, in order to exclude or reduce to a minimum the possibility of errors in programs and their documentation. Processing and complementing must be consistent with current standards. We must not belittle the commercial aspect: diskettes and manuals must be placed in folders or between hard covers, including advertising and

demonstration and training materials. Thus use of software must be backed by guaranteed maintenance and a short training for users.

On Similarity and Differences in Making Films and Software Products; Links Between Producers of Technical Facilities and Software for the Latter; General Discussion of Unprogrammed Problems of the Software Industry

It is frequently pointed out that making software is like making a motion picture: most of the cost is that of creating the first copy (the gold copy). This opinion developed at a time when only programs and not software products were being made. Today the cost of duplication and sales (including the training of users, guaranteed maintenance, systems aids, advertising, etc.) ranges between 20 and 40 percent for general expenditures and, in some cases, reaches as high as 70 percent.

Improperly, Directive No 8 of the former DKNTP, as well as more recent legal stipulations, ignore such expenditures.

The duplication of software products along with parallel activities, generically described as "accompanying software," should be the subject of greater attention on the part of responsible departments and organizations. They must allocate a great deal more material resources (particularly for duplicating equipment) and a great deal more personnel. Otherwise a number of software products will reach the consumers in an form which will prevent their practical application.

This problem is so important that we should consider the need for new organizational methods for its solution. Positive examples are available. The software enterprises of the Software Products and Systems SO and the National Program and Design Fund Economic Combine (under its jurisdiction) allocate a significant amount of their resources for accompanying activities. However, we have no analogues of foreign software consulting companies. That is why some leading software support institutes could develop specialized duplication and support units. We must also upgrade the quality of such activities by strictly observing regulations on the fast elimination of noted errors in software products. This is mandatory, for a single error in programming could make the product not only unusable but also damaging to the user. According to both CEMA and Bulgarian standards, if an error is found all organizations which have purchased the product must be informed quickly. However, the observance of adopted standards is not suitably controlled at the present time neither by developing nor follow-up organizations and units.

Practical experience has long confirmed that a software product which is not steadily perfected quickly becomes unusable. Normally, applied software includes several, as many as 10-15 modifications, which broaden opportunities. In our country, however, new modifications are rarely created. The erroneous opinion even exists that this would help developers to "correct their errors." For that reason, a number of useful software products "perish" quickly.

Las must be passed to regulate ways of improving the software product (by introducing, for example, stages UI, UII, UIII...). The period of perfecting the product and the necessary resources should exceed development costs.

The specific nature of the production of software products and the different views of some central departments on basic problems of the software industry have been delaying, for the second year, the drafting of regulations which should have been enacted in accordance with Decree No 34. Such regulations are necessary. They would settle problems pertaining to the production of and trade in software products. We must also solve as soon as possible the problem of how to provide incentive to the developers in order to expand the country's software resources without allowing unearned income. In other words, we must properly regulate the work of programmers.

The problem of authorship rights is also awaiting its solution, on the legal level if necessary. This is a complex problem. Nevertheless, some laws in this area have already been passed by some countries (in the United States in 1980 and Japan, the FRG and France, in 1983).

The development of the software industry also suffers from a chronic shortage of books on programming. We are seriously lagging behind what is known abroad as "bookware," i.e., availability of textbooks and books. This problem seems basic but is exceptionally important, for benefits on a national scale from the publication of about a dozen such books in sufficient editions may prove substantial.

The industrial technologies used in the development of software products demand of programmers to have automated work places--complexes of technical and programming facilities for automating design activities, programming, testing, documenting and software support. In our country, a small number of organizations introduced, relatively late compared with the advanced countries, systems for interaction with mainframe computers and technological programming facilities. In the case of smaller computers, however, such as the SM-4 and, particularly, the PC, the lag separating us from the most advanced countries has been substantially reduced. Nevertheless, by no means has everything necessary been done to ensure the programmers the use of translators from programming languages, with an extensive set of service facilities (a programming environment), high-quality technological items for designing, editing and testing programs, means for the automatic transfer of developed programs from one computer model to another or from one operational environment to another, etc.

The introduction of new technologies requires an efficient personnel training and retraining system. The higher educational institutions are training good specialists in programming. However, technological training is acquired mainly on the job. That is why it would be useful for the young specialists joining small organizations without extensive facilities to undergo at least 2-3 months' training at leading institutes. This problem must be solved by the competent departments and with the agreement of the organization to which the young specialists have been assigned. Furthermore, worldwide practices indicates that in order to maintain a the high-level efficiency of a programmer he must undergo refresher training at least 1 month every year, and acquainted with new languages and programming environments, new models of technical facilities and operational systems and new technologies.

The Bulgarian programming industry is still in its initial development period, for which reason its difficulties and weaknesses are understandable. However, in order for it to develop successfully, in the spirit of the resolutions of the 13th BCP Congress, the production of software must be related more closely to that of technical means; legal problems, as earmarked in Decree No 34 of the Council of Ministers of 1984, must be solved. The economic base of the subsector must be improved by intensifying economic incentives and penalties, in order to achieve a drastic upturn in improving programming technology. Proper attention must be paid to strict quality control.

In order for all of this to be accomplished, a change in the way of thinking of many managers and specialists on different levels must be achieved. The problems of the software industry, a new subsector which should not be squeezed within the traditional economic management confines, must be resolved creatively. The high science-intensiveness of software activities and the absence of outlays for energy and raw materials simply obligate us to maintain a high rate of development of this subsector during the 9th 5-Year Plan and gain positions on the world market and in the socialist division of labor, and find our proper place in the implementation of the comprehensive program for scientific and technical progress of CEMA members. The high professional competence and high conscientiousness of most Bulgarian programmers guarantee the implementation of these tasks.

Ruse Software House

Sofia TEKHNICHESKO DELO in Bulgarian 17 May 86 p 5

[Article by Boyan Draganov, Ruse Okrug Correspondent]

[Text] The specialized software enterprise (Software House) in Ruse was established 1 year ago. Its short life has not prevented its small collective from developing its creative possibilities and achieving encouraging results. So far, more than 400 programs have been written essentially for agricultural production, trade and the food industry. The special feature of the Ruse Software House is the development of comprehensive standardized hierarchical automated control systems. Software modules for the automated control system for subunits of the Rodopa SO (based on the SM-4) have been completed on the basis of the Rodopa Combine in Ruse. The system enables the automation of management problems, such as planning, accounting, daily management, control and analysis.

An automated system for information and management of a trade base, targeted for the Turgovska Baza in Ruse, has been installed. It covers the daily management of intrawarehousing processes, follows up and records contract, planning, financial-bookkeeping activities, etc. Such software interested specialists at the International Autumn Industrial Fair in Plovdiv last year.

Particularly extensive work has been done for the Drustur Agroindustrial Complex in Silistra. The Drustur automated control system covers the development of information system on the okrug level of the OAPK (OAPS). This software product meets the needs of planning and accountability information for agriculture on the okrug level with territorial information-

seeking systems (for material and technical procurements, cadre management, marketing and selling). The system can analyze and determine patterns and trends in the development of the territorial agricultural system and allows the use of economic-mathematical models for the optimizing and development of territorial data bases.

A three-step hierarchical system--OAPK-APK-brigade and livestock farm--has been developed. Software systems based on 16-byte computers are being applied. A link is being established between microcomputers and the mainframe computer for transmitting information by modem.

Specialist at the Ruse Software House are actively participating in the application process. They are training personnel for work with software, in Ruse and on-site. They try to present design documentation in an aspect which makes the work convenient and easy. Concern is being shown for the better external presentation of software products. In the future, specialized company labels will be used. All consumers have been given an advertising diskette and a diskette with a control example. A 1-year maintenance guarantee is given; however, if an error is detected, it is eliminated as rapidly as possible, free of charge, regardless of the time lapse.

The Ruse Software House has extensive production potential. It can develop, istribute and apply software products for the entire okrug economy. Good equipment and highly skilled specialists are available. However, the connection between okrug enterprises and the Software House is not on the necessary level. One of the reasons is that virtually all big combines and economic organizations have their own computers, some of the capacity of which remains frequently unused. That is why the Software House provides services essentially to medium-sized and small enterprise which it supplies with microcomputers and software systems. According to Candidate of Economic Sciences Yordanka Velcheva, director of the Ruse Software House, if a given problem can be resolved with microcomputers neither mini-computers nor mainframe computers should be used, for data processing with them becomes substantially costlier.

The main reason for the insufficient use of computers in all areas of the economy and daily life, however, is the unsatisfactory level of existing material facilities. The possibilities of the available Pravets-82 microcomputers are limited. The more extensive use of software products decisively depends on saturating the market with the more advanced 16-byte Pravets-16, Izot-1036 and Izot-1037 microcomputers. A great deal of questions also remain to be solved in servicing Pravets computers.

Let us not ignore a question which has been quite extensively discussed: the psychological barriers blocking some economic managers. Software house specialists are forced constantly to prove the advantages and possibilities of computers and software programs. That is why, in the future they will develop standardized functional modules for planning, accounting and analysis in agriculture and industry, which will have great multiplication effect, automated economic-mathematical modeling and optimizing of planned assignments. Great attention will be paid to providing software support for work under the conditions of local machine networks.

Vratsa Software House

Sofia TEKHNICHESKO DELO in Bulgarian 17 May 86 p 5

[Article by Tsvetana Evgenieva, Vratsa Okrug correspondent]

[Text] The Vratsa Software House, which was the seventh such enterprise to be created slightly more than a year ago, is specializing as an enterprise providing territorial software support. It was quickly staffed with proper personnel. Its main purpose is to develop software facilities, thus contributing to the accelerated automation of a variety of economic and management activities, help in the use of microprocessors, and distribute software products developed by other houses. To the consumers, it is a comprehensive supplier of equipment and software systems for various purposes.

Engineer Lilyan Naydenov, director of the Vratsa Software House, described its beginning:

We tried to make use of the our practical experience acquired in the development of automated control systems. We aim our programs for use with Bulgarian microcomputers we have at our disposal. In our House we work with Pravets-82 and other equipment.

The initial software systems were developed by the Software House with the help of the okrug people's council and were related to automating quality control and scientific and technical progress. We expect that they will be used in preventive quality control of output and, simultaneously, eliminate errors in the production of okrug structure-determining items.

In the area of scientific and technical progress, results are sought elsewhere: authorship groups are being put on file, the cost of revising topics is kept under supervision and economic results are determined. The greatest attention is paid to the final objective, which is the repeated application of each developed topic.

In this sense, the system of outpatient treatment of kidney-disease patients is a major accomplishment of the Vratsa Software House. It has already been applied at the okrug hospital and is to be applied in dozens of medical offices throughout the country. The "Automated Work Place" system can be applied at each loading and unloading railroad station, where the waiting time of each car is tracked by model, freight and direction.

Significant social results are obtained with the system for settling basic bookkeeping accounts or, in short, the FSD Synthetic Calculator, written as standard for the entire country. Its purpose is to automate the work of the bookkeeper drafting turnover documents, relieving him from several activities, such as keeping debit and credit books for main accounts, and the main bookkeeping record, and to check disparities. A synthetic calculator has been applied also by the okrug roads administration, the rayon standardization center, the Veslets ChLK, and the Mezdra BKS and given to the houses in Gabrovo and Razgrad for distribution. Applied software has been developed for

metrological support, developed by the rayon standardization, metrology and quality control center.

The Vratsa Software House has great ambitions. Its rich creative program includes software systems for the automated control of territorial planning in order to ensure its optimal combination with sectorial planning; systems for daily control of material and technical procurements and material stocks in individual enterprises, the status of migration processes and even a system recording bearers of orders and medals. The aspiration is for the new technical facilities quickly to become part of the production and social areas and turn into boosters of scientific and technical progress.

Figure Captions

Page 1: Complete information on software products developed in our country may be obtained at the trade demonstration complex of the National Software and Design Fund Combine.

Page 4, No 1: The trade-demonstration complex in Sofia, developed by the National Software and Design Fund Combine, offers consumers of software products in the country wonderful opportunities to become acquainted with technical automation facilities, software and publications explaining their most efficient use.

Page 4, No 2: If greater interest is shown in a software product, specialists can display programs immediately, at the demonstration hall of the complex.

Page 4, No 3: A customer who can handle a computer can see for himself whether or not the algorithm of the software product is applicable under specific conditions.

Page 5, top: Engineer Ivan Tomov, a member of the team developing software for our computer networks, shown demonstrating a new software product.

Page 5, center: A collective headed by Rumyana Kharalampieva is writing programs for the Drustur ASU.

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MAGYAR ELEKTRONIKA, TABLE OF CONTENTS

Budapest MAGYAR ELEKTRONIKA in Hungarian No 2, 1986 pp 2-3

On Our Cover

On our cover one can see a graphic photomontage by Laszlo Vasvari. The vision of the artist represents the spread of electronics; his composition has perspective and elan. We all hope that the electronization program will be successful and will give an impetus to our social and economic development.

Devices

The Videoton developers appear with another significant achievement, the laserxerographic printer. The printer is described in two articles. Karoly Paulinszky and his colleagues describe the operation and chief functional units of the device while Istvan Ecsedi and Tibor Pojjak describe the emulator and the services that can be obtained with it. This is the first development in a family of heavy-duty printers to go into production (soon) and it fits the computer technology system not only of Hungary but also of CEMA.

Applications

The most significant areas for the use of electronics are those where mechanically repeated operations or operations requiring hard physical work must be done by machines and the entire process must be automated. The control system developed by the SZTAKI [Computer Technology and Automation Research Institute] and given the abbreviation LAOCON can be used very advantageously in materials movement, packaging technology, machine tool control and other control technology areas. A configuration intended for warehouse use can be seen on our back cover.

The people at the Lorand Eotvos Geophysics Institute have developed a containerized computer system for fast processing of seismic measurements done in the field. The system is based on an R 10, it is transportable and so can be located near the research site and its climatization suits even Siberian conditions.

Control Technology

There are two articles in our control technology column. The second installment of Sandor Mucsi's series deals with the control technology use of microelectronics, with distributed system structures. Lajos Ocsai describes the structure of the MEV robot control system.

Circuits

Our circuits column always arouses the interest of our readers, but that is not enough for us. We would like not only to be able to use the switches and ideas published but also if you would send in similar ideas. This would be useful even if a patent protects the solution; it might bring some business. We await your ideas!

Advertisements, Product Descriptions

MAGYAR ELEKTRONIKA is an ever more popular advertising medium, as indicated by the number of copies, its readership and--at least we hope--its quality of presentation. Few know that in our case the graphics people design the advertisement from the raw material and the design fee is in the price. If additional information is needed turn to our editors.

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VIDEOTON'S LASERXEROGRAPHIC PRINTER

Budapest MAGYAR ELEKTRONIKA in Hungarian No 2, 1986 pp 10-15

[Article by Istvan Barath, Ferenc Kadar, Karoly Paulinszky and Ferenc Rakoczi: "Development of Laserxerographic Printer at Videoton"]

[Text] Introduction

One of the most important characteristics of the computer technology development of recent years is that computers are departing from their traditional user environment, from the machine room, and have gone to the place which gives rise to the information to be processed, to the offices, laboratories and shops of the engineers. This process was started by the reduction in the size and price of processors and memories and it necessarily brings with it the development of new, cheaper, higher capacity families of input and output devices which can be used in the new environment.

In the development of printers the effort is primarily to reduce the size, weight and noise while increasing the graphics presentation capability. The first examples of the first laserxerographic printers appeared at professional shows 4-5 years ago to meet the above goals and in 1985, at the Hannover computer technology fair, more than 30 firms offered small size, good quality non-striking A4 and A3 format page printers.

In regard to their speed these printers can be put into three categories:

--a maximum of eight A4 pages per minute: for personal computers,
--eight to 60 A4 pages per minute: special page printers for small computers,
--2,000-20,000 lines per minute: fanfold printing, high speed line printers.

The resolution of these printers is 200-400 elementary points per inch.

The system profile of Videoton calls for devices in the second group, working noiselessly, of medium speed and suitable for graphics printing. At present these devices agree in that they are based on electrophotographic or xerographic basic units which we know well from office copying technology.

The various manufacturers realize the production of images in different ways. There are image producing units working with laser beams, gas and semiconductor lasers, micro-LED lines, liquid crystal grids and microchamber iongenerators. The Videoton Computer Technology Factory--in accordance with its developmental ideas--has been dealing intensively since 1982 with the development of a small size, medium speed, non-striking page printer. After experiments with a number of different xerographic methods--with gas and semiconductor laser beam sources--the Developmental Institute--in harmony with the developmental strategy ideas--created in 1985 a turning mirror diverting, He-Ne gas laser beam source, acousto-optical modulator, anorganic photoconductive layer xerographic laserxerographic printer.

After international testing in the SM series uniform computer technology system of the CEMA countries the printer received the code SM 6314. In our article we describe the chief parameters, operating principle and structure of this printer.

The chief parameters of the printer are:

Printing speed: 9-12 A4 pages per minute,
Paper which can be used: A4 gull copying paper,
Resolution: 10 points per millimeter,
Dimensions: 600 mm x 550 mm x 420 mm,
Weight: 48 kilograms,
Noise level: <60 dB, and
Interface: Videointerface.

In describing the structure and operating principle we break the device down into the following chief units:

1. Electrophotographic and electromechanical unit, which performs paper advance, charging the light sensitive cylinder, developing the charge image and fixing the ink.

2. The laseroptical block, in optical contact with the former, which, controlled by the electronics, forms the desired charge image on the charged light sensitive cylinder.

3. A system based on an 8 bit microprocessor which controls the printer.

The Electrophotographic and Electromechanical Unit

In essence the electromechanics can be regarded as a xerographic copying machine in which the image information to be printed is sketched on the light sensitive cylinder not by an optical projection system but rather by a suitably diverted and modulated laser beam. The latent image which forms on the cylinder becomes visible with an ink coating. The ink goes onto the paper, then the ink particles stick to the paper as a result of heat. In this way the image information received in the form of electronic signals appears on the paper.

To carry out this process the printer contains the following functional subassemblies:

--electrophotographic unit,
--paper handling mechanism and drive, and
--recording unit.

The Electrophotographic Unit

The electrophotographic unit consists of the light sensitive photoconducting cylinder, the corotron which charges the cylinder with positive charges, a magnetic brush inking unit to bring out the latent image formed after electron beam illumination, a copying corotron transfering the ink from the cylinder to the paper, an alternating AC corotron aiding separation of the paper and the cylinder and illuminating devices to discharge the charge remaining on the cylinder.

The copying cylinder is a light sensitive photo conducting layer on a well conducting aluminium carrier material; here the layer is an Se alloy about 70 microns thick. The sensitivity of the Selenium cylinders used in the customary Xerox copying machines is not satisfactory at the wave length (633 nm) of the He-Ne laser used in the laser printer, because an excessively great laser output would be required to attain the desired printing speed. We succeeded in increasing the red sensitivity of the cylinder with a suitable alloy and technology so that the desired printing speed could be achieved with a 5 mW laser output. (Experiments are continuing to increase the red and infrared sensitivity of the photoconducting layer, which will make possible a reduction in the necessary laser output and make it possible to use a semiconductor laser diode radiating in the infrared range--about 830 nm.)

Determining the circumferential speed of the photoconducting cylinder, and thus the attainable printing speed, is primarily a function of two technical parameters. We prescribed the resolution of the laser printer at a value of 10 points per mm in the horizontal and vertical direction. Because of the optimal efficiency of the acousto-optical modulator available to us we selected a modulation frequency of 2.3 MHz. It follows from these data that the laser beam scans the surface of the copying cylinder to the end every 1.5 milliseconds, during this time the surface of the cylinder must move 0.1 mm; so the necessary circumferential speed is 66.66 mm per second.

The surface of the photoconducting cylinder must be charged to a potential of about plus 1,000 V for reliable image formation. This is the task of the charging corotron. The corotron is a thin wire with a diameter of 0.06 mm to which we connect a voltage of about plus 5,000 volts. As a result of the great field force developing about the thin wire a corona discharge is created, upon which the air in the environment is ionized. The ions with positive charge migrate to the surface of the cylinder. The surface potential which can be attained depends on the properties of the photoconducting layer, the magnitude of the corona current and the time under the corotron, or on the circumferential speed of the copying cylinder.

The resistance of the photoconducting layer decreases as a result of illumination, the charges leave the illuminated surface through the aluminum cylinder connected to the ground potential. The charges remain at the unilluminated places. While we scan the cylinder with the laser beam with the aid of the acousto-optical modulator we "extinguish" the beam where we want to have a black point on the cylinder, or on the paper. Thus the latent image is made up of positive charged points on the surface of the discharged cylinder, an image which we want to display on the paper in a visible form.

The inking unit is to develop the latent image. For magnetic brush inking we use a two component dry ink, which consists of ferromagnetic carrier particles (developer) and finely dispersed ink particles (toner) which, sticking to the carrier particles, coat the surface of the former.

The "hairs" of the magnetic brush are formed by the ferromagnetic carrier particles arranged along the magnetic force lines which "sweep" the surface of the cylinder as the cylinder and magnetic brush turn, thus transferring the ink to the cylinder.

The well selected carrier and ink materials are placed in the potential line in such a way that as the mixture moves the carrier material will have a positive charge and the ink particles will have a negative charge (the triboelectric phenomenon). The negatively charged ink sticks to the positively charged spots on the copying cylinder if the electrostatic force effect from the part of the cylinder is greater than the attractive force between the carrier particle and the ink particle.

In theory the toner is consumed and the developer remains. An automatic feeding of toner is necessary to maintain the toner concentration; 125 grams of toner is sufficient to print about 2,500 A4 sheets. But after printing 15,000 pages it is also necessary to exchange the developer to maintain the contrast. Since there is a residual voltage of several times 10 V at the places discharged by the laser beam the efficiency of the inking and the desired contrast of the image to be displayed can be influenced by a bias voltage of several 100 V appearing on the electrically conductive carrier material (developer) and connected to the inker.

The image developed on the cylinder must be transferred to the paper. The copying corotron does this. The copying corotron, similar in design to the charging corotron, provides positive charges to the back side of the paper meeting with the cylinder to such an extent that as a resultant of the electrostatic forces the ink particles are transferred from the cylinder to the paper and the proceed with the paper after separation of the cylinder and the paper. An alternating current (AC) corotron aids separation of the cylinder and paper; it neutralizes the positive charge on the back side of the paper, thus decreasing the adherence of the cylinder and the paper and faciliting the work of the separating teeth.

After separation of the cylinder and paper the residual charge on the turning cylinder must be removed, so we must illuminate the surface of the cylinder with a suitable light source. Then the above described process is repeated on the cylinder.

Paper Handling Mechanism and Drive

The A4 copying paper sheets used in the laser printer are contained in a cassette. A rubber roller picks the sheets out of the cassette and passes them to the paper advancing rollers. When the entering edge of the paper approaches the copying cylinder the paper stops at a precisely determined starting position. It then starts again precisely synchronized with the image information written on the cylinder by the laser beam so that the information intended for the top of the sheet really goes there. Electronically controlled magnetic axle switches start and stop the paper drive rollers.

We use a synchronous motor to drive the roller and paper moving mechanism to aid the combined operation of the quartz crystal controlled mirror turning motor and the xerographic system.

Fixing Unit

The information can be seen on the paper as it leaves the cylinder but it still could be erased. The ink must be fixed to the paper. The synthetic content of the ink particles melts at about 160 degrees Celsius and sticks to the paper. A lamp provides the necessary radiant heat; its output is regulated so that the ink particles melt on the paper proceeding under it at a given speed but the paper does not burn. Protection against overheating is provided electrically and mechanically--with a swinging shading panel.

The Laser Optics System

The purpose of the laser optics system is to create by photo exposure on the surface of a turning, light sensitive, photoconducting--xerographic--cylinder supplied with a homogeneous electric charge that charge image necessary to produce a written or printed image of predetermined resolution.

Strict energetic, optical and dynamic conditions harmonised with the type of cylinder selected must be satisfied to create the desired charge image photo exposure. Figure 2 shows this as a block diagram. The system operates as follows:

A laser power unit (1/1) excites the He-Ne laser source (1) which emits a plane polarized laser beam which with the aid of a beam control mirror (2) goes through a circular polarizer (3) and the first corrective optics (4) into the acousto-optical modulator (5) which at a moment determined by the control electronics (5/1) breaks down the beam or diverts it according to the rate of control (time elapse). Without modulation no light reaches the cylinder so there is no photo exposure and no charge image because the light path is open only to a diverted and modulated beam. In the event of modulation the diverted beam passes on with the aid of the beam guide mirrors (6 and 7) through another corrective optics (8) to the many-surfaced many-angled diversion mirror (9) which is turned by a mirror motor (9/1) at a constant number of revolutions with the aid of a quartz precision motor control (9/2).

The beam diverted by the turning mirror scans the designated path on the cylinder jacket a number of times per revolution--in accordance with the number of mirror surfaces--in such a way that passing through a third corrective optics (10) and with the aid of the line mirror (11) it reaches the surface of the cylinder jacket creating an elementary line of the desired charge picture for each mirror surface on the photoconducting cylinder (12) which is turned by the synchronous motor (12/1). The scanning beam takes care of synchronization of the modulated beam with the aid of a line edge detector (11/1) which generates an authorizing signal for the beginning of active modulation within the line, and thus the line-by-line interval of the charge image made up of individual elementary points.

Control Electronics

A system based on an 8 bit microprocessor controls the printer. Figure 3 shows its structure.

The chief units of the control electronics are:

--a unit providing synchronization and the interface process,
--modulator electronics controlling the laser beam,
--electronics controlling the diverting motor,
--electronics controlling the xerographic block and paper advance,
--the control microprocessor block organizing the cooperation of the several units, and
--a switched mode power supply.

It can be seen from this that the microprocessor must carry out a very complex task. From the design viewpoint a special problem was presented by the quite noisy environment (corona discharges, magnetic axle switches) which had to be eliminated by using four-layer cards and suitable shielding and by a circumspect layout, thus making possible reliable operation of cheaper TTL level electronics.

The laser printer has a byte organized video interface. In the interface one can find, in addition to the "handshaking" signals taking part directly in data transmission, signals giving various error indications, signals facilitating operation in a system. This makes possible a complete diagnosis of the printer from the system side.

Since there is no memory in the laser printer for the information to be printed care had to be taken to synchronize the receipt of video information and the diverting system. This also means that severe restrictions had to be put on the data transmission speed of the control system.

Quartz controlled special purpose hardware developed for this purpose provides the synchronization. If something falls out of synch (for example if the using system cannot provide the next video byte in time or if the revolutions of the diverting motor change more than permitted, etc.) an error signal precisely designating the cause of the error is given to the user system.

A stepping register transforms the byte organized video information into a serial video signal. The resolution is ten points per millimeter. The number of bytes transmitted per line is 256, corresponding to the 10 points per millimeter resolution. After completion of handing on the video information belonging to the given page the video signal has a "white level" value to the end of the page.

The video information synchronized to the diverting system controls the circuit driving the acousto-optical modulator. In accordance with the information it provides an ultrasonic signal with 45 MHz packets and this modulates the incoming laser beam. The drive circuit is an independent unit made up of hybrid circuits.

After beam formation the modulated laser beam goes to the diverting system. A quartz controlled, closed loop control had to be developed to control the mirror turning motor. The control processor gives the user an error signal if the number of revolutions falls outside the given limit value.

After receiving the print command the control processor initiates the lifting of the sheet from the cassette and puts the sheet into the printing base position. The processor constantly checks the movement of the mechanics. With the aid of sensors at the appropriate spots it can follow the printing process to the end. If there is a hitch the printing process stops and the device indicates the cause of the error. At most three sheets can take part in the printing process at one time. Before completion of the printing process the drive system can indicate to the laser printer that it can initiate putting the next sheet into synchronous position. Depending on the stage of the printing process there is an error indication or, if the paper is hung up, the user gets information about the number of sheets to be repeated.

Controlled high voltage generators (5-6 kHz frequency 4-5 kV alternating or direct voltage) produce the corona voltages needed for xerography. The inking unit and the fixing lamp are controlled by special purpose analog circuits--under the control of the processor.

In regard to the circuits of the controlling microprocessor system:

--it is based on an 8 bit microprocessor,
--a 2732 EPROM stores the microprogram of about 2 K bytes,
--the peripheral control IC and the input-output ports are embedded in memory,
--longer timing is entrusted to a special, digital time recording circuit.

For the time being we have fitted the printer to a computer manufactured by Videoton. The present control electronics offer emulation of an intelligent, alphanumeric-semigraphic line printer.

The very complex tasks of development could be solved only with broad cooperation. The MOM [Hungarian Optical Works], MIKI [Instrument Industry Research Institute], IMI [Industrial Instruments Factory, Iklad], the Budapest Technical University, the MEV [Microelectronics Enterprise] and the Technical Physics Research Institute of the Hungarian Academy of Sciences cooperated in designing and manufacturing the subassemblies.

The members of the Videoton team were: the authors, department chief Imre Nagygyorgy, Peter Dusnoki, Mrs Mihaly Matolcsi, Tamas Kovacs, Dr Tamas Sziranyi, Geza Ujhazy, Istvan Salfay, Istvan Vincze, Ivan Mogorosi and Jozsef Tarcsi, developmental engineers.

The Path for Further Development

Parallel with putting the printer into manufacture we are developing a semiconductor laser diode optical module. The further development of electrophotography is aimed at development of infrasensitive cylinder coatings. In addition to simplifying the mechanics and electronics we are planning heated cylinder burn-in in place of fixing with radiant heat, an expansion of services and a reduction in production costs. We are conducting experiments on another optical principle to produce the charge image. We are also studying the applicability of liquid crystal modulators.

It is the goal of Videoton to deliver to its users during the new 5-year plan small size, noiseless devices offering outstanding graphics possibilities for the new, swiftly spreading computer technology applications.

Authors

Istvan Barath. I was born in 1946 in Izsak. I graduated from the electrical engineering school of the Budapest Technical University in 1971. I have worked in the Developmental Institute of Videoton since 1974. In 1976 I completed the special engineering section "System Design of Digital Equipment." My tasks have included adapting the Videoton line printer family to ESR and IBM systems. At present I am responsible for the electronics in the laser printer development. I am married and have a daughter 12 years old. In my free time I like to listen to music, I like sports, travel, excursions and machines but the real relaxation for me is gardening.

Ferenc Kadar. I was born in 1930. I graduated from the weak current branch of the Budapest Technical University in 1954. I started work at the Transportation Measuring Instruments Factory where I was leader of the developmental laboratory between 1955 and 1961. I worked as a scientific colleague at the Optical Research Laboratory and at its legal successor the Videoton Developmental Institute. I participated and am participating in overcoming the professional problems of changes in profile, in the various undertakings of the instrument-nuclear-computer age. Since the beginning of my career I have been attracted by the problems of the border areas of the profession and the experimental work connected with them. At present I am occupied with the applications technology of optical, optoelectronic and laser devices as a group leader and so participated in solving the tasks of the laser printer R & D project. Because of a life as a devoted researcher I have virtually no free time but if I do I seek relaxation in the society of art, music and books.

Karoly Paulinszky. I obtained my electrical engineering diploma in 1970 at the Moscow Energetics University. Since 1971 I have been working at the Electronics and Precision Engineering Research Institute and at its legal

successor the Videoton Developmental Institute. My first jobs were designing and connecting computer peripherals. From 1972, as chief of a developmental group, I dealt with magnetic tape and floppy disk stores. From 1976, for a few years, I led the Bulgarian office of Videoton; since then I have again been working in the institute, as chief of a developmental department. The task of our department is primarily the design of striking and non-striking printers. In 1982 I got the assignment of starting and leading the laser printer project. I am married. In my free time (if any) I read a lot, I like to listen to serious music and I like to play chess, go to the theater and go on excursions.

Ferenc Rakoczi. I received my mechanical engineering diploma at the Budapest Technical University in 1953. For 5 years I worked there in the Technical Mechanics faculty dealing with the theory of mechanisms as an assistant professor. In 1959 I went to the legal predecessor of my present place of work, the Optical and Precision Engineering Center Research Laboratory (OKL) where I was a scientific colleague, from 1964 a chief scientific colleague and from 1970 a scientific group chief. I dealt with the development of precision engineering and electromechanical structures, primarily recording and printing devices. In 1961-1963 I completed the special engineering course in nuclear electronics. From 1963 at the institute called the Electronics and Precision Enginnering Research Institute (EFKI) and since 1971 at the Developmental Institute of the Videoton Electronics Enterprise I participated as developmental group chief in the development of the Videoton line printers. I have studied in Japan and have visited the United States. At present I am working on the development of a laser-electrophotographic printer. I like to read, take photographs, travel and cook.

FIGURE CAPTIONS

1. p 11. Mechanical sketch of the Videoton laser printer.

2. p 13. Sketch of the optical system of the Videoton laser printer.

3. p 14. Videoton laser printer control electronics.

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LINE PRINTER EMULATION WITH LASERXEROGRAPHIC PRINTER OF VIDEOTON

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[Article by Istvan Ecsedi and Tibor Pojjak: "Line Printer Emulation With Laserxerographic Printer of Videoton"]

[Text] Introduction

Parallel with the development of the laserxerographic printer in the Videoton Developmental Institute a video control unit was prepared which together with the videointerfaced printer creates a line printer emulator. The emulator created in this way is capable even of services surpassing the properties of customary line printers.

The video control breaks down functinally into four chief parts:

--the interface processor,
--the page memory,
--the character generator, and
--the video processor.

In the following we will briefly describe the hardware structure of the functional units of the video control and the basic principles of their operation.

The Interface Processor

The task of the interface processor is to take care of data transmission between the computer and the video control and to structure an entire page of data to be printed in page memory in a form which the video processor can understand. The interface processor handles two page memories. Thus, parallel with the printing out of the contents of one of the page memories the data for the next page can be read in. Thus even with low data transmission speeds the printing performance is not reduced.

As can be seen in the simplified block diagram (Figure 2) the unit carries out its tasks under the control of an 8 bit microprocessor. A PROM area of 8 K bytes is available to store the operating microprogram; the free RAM area which can be used by the processor is also 8 K bytes. A programmable

peripheral interface creates a link for the unit with the user system and the video processor. With the aid of the MEMORY CONTROL BUS the processor links the page memory and character generator modules to the interface and video units.

The Page Memory

The unit contains two page memory modules each of 16 K x 16 bits. The memory modules capable of storing one page of data consist of two parts, each of 16 K bytes. The part called the text memory stores the ASCII codes of the data to be printed and the base codes of the format commands interpreted by the video processor. The other part, called the supplementary memory, stores the other information needed to operate the video processor. Data can reach the page memory only from the interface processor, but it is possible to read out of it from both the video processor and the interface processor.

The Character Generator

The character generator can contain at most four modules (character sets). Each of these is 16 K x 32 bits, capable of storing the point by point images of 224 characters. Any module can be permanently burned in or loadable. We store the permanently burned in character sets in EPROMs while in the case of a loadable store the user must load the available RAM area through the BSI interface.

The size of the cells of the character generator modules serving to store the point by point image of one character is a maximum of 32 x 64 video points. The concrete cell size of the character sets can deviate from this (can be smaller). In the case of the letter size and writing density customary in line printers, for example, the cell size is 24 x 40 video points.

In the case of the loadable character generator module the user selects the cell size within the above limits.

In addition to the point by point images of the characters the character generator also stores the so-called width data. The video processor uses this data, giving the actual width of the character, in the event of proportional writing.

The Video Processor

The task of the video processor is to structure the print image point by point on the basis of codes read from page memory with the aid of the character generator. The video information obtained in this way is passed byte by byte to the video interface of the printer.

The structure of the video processor can be seen in the block diagram in Figure 3. The video processor consists of a control microprocessor and hardware units--not programmed--built around it which create a link toward the page memory, character generator, video interface and interface processor.

The control microprocessor is an 8 bit microprocessor built up of bipolar elements which has an instruction word length of 20 bits, a program store capacity of 1 K words and an instruction cycle time of 135 ns. The relatively small program store capacity is compensated for by the fact that the instruction set of the processor also contains instructions which support fast operation, adjusting to the task; with a traditional processor structure their effect could be realized only with additional instructions. This processor permits a video interface data transmission speed of at most 925 K bytes, that is, it makes possible the driving of a laser-electrophotographic printer with a video signal frequency of 7.4 MHz. (The 7.4 MHz video signal frequency here does not mean the band width of the signal but rather the possible frequency of black-white or white-black color changes.) Thus the video control is capable of driving printers with a greater video signal frequency, that is greater printing capacity, than the Videoton printer, because the Videoton printer has a video signal frequency of 2.3 MHz.

The video interface uses a double "hand-shaking" technique, which makes it possible for the printer to synchronize data transmission to its own turning mirror diverting system and paper advancing system. The control of data transmission can be followed in the time diagram in Figure 4.

The role of the two "hand-shaking" control signal pairs is as follows:

--The PRINT REQUEST signal of the video control and the PRINTING IN PROGRESS signal of the printer synchronize the writing on the electrophotographic cylinder, or the data transmission, to the movement of the paper.

--The DATA VALID signal of the video control and the DATA RECEIVED signal of the printer synchronize the transmission of one video line of data (256 bytes) to the turning mirror diverting system.

A parallel-serial transformer produces the video signal of the video processor from the 32 bit parallel information of the character generator. It is an apparent contradiction that despite the byte organization of the video interface the video signal has a "one bit organization." In order to realize so-called proportional writing (see below) the units of character generator information which cannot be expressed in a whole number of bytes must be fitted one beside the other, which can be solved simply by loading the stepping register of the parallel-serial transformer--at the appropriate time. The control of the video interface and the microprocessor together control the operation of the parallel-serial transformer.

The page memory addressing unit and the page memory register make possible the link to page memory.

The page memory addressing unit consists of a 16 bit counter and a 16 bit store the operation of which is controlled by the microprocessor. With the aid of these the microprocessor scans an area of the page memory corresponding to the print line in order to address the appropriate "targets" of the character generator, then returns to the initial address of the given print line, which the 16 bit store contains. It performs this operation for each video line

until all the video lines of the print line have been produced in the video interface.

The page memory register is 16 bits and writing into it is controlled by the microprocessor. The lower place value byte of the register contains the code of the character to be printed, which gives a part of the address bits of the character generator. The microprocessor also studies this byte from the viewpoint of command codes. The higher place value byte carries so-called supplementary information. Here the video processor gets other information connected with the depiction of the character--the number of the character generator module (0-3), the horizontal size of the character generator cell, the instruction for proportional writing, the size of the changeable width inter-word space, data pertaining to print line distance, the cell height size of the print line, etc.

Addressing the character generator and accepting its output represents the link to the character generator. Addressing the character generator is made up of the code of the character, the number of the character generator module and the video line number provided by the microprocessor. This latter means the video line number within the cell. The outputs of the character generator form a 32 bit output bus and a 4 bit width information carrying bus, which is necessary for proportional writing.

Finally, the control microprocessor is also in contact with the interface processor. From it it receives the command pertaining to the printing out of one page of information and it indicates to it that the printing has been done.

Services of the Video Processor and the Basic Principles for Their Realization

Evenly Divided Writing--Proportional Writing

The video processor can handle two writing modes:

--In the case of evenly divided writing every character has a field of the same width on the paper, the individual characters are placed in the middle of this field. Thus the characters of each print line with the same sequence number are placed one below the other and the characters of the printed text show a columnar order as well as being ordered in lines. The write image of most printing equipment used in computer technology is like this (line printers, matrix printers, typewriters, etc.)

--In proportional writing every character has a field of the width actually needed on the basis of the width of the given character. Thus in this writing mode the columnar order does not develop. The write image of products prepared by printing is generally like this. Today, however, printers which are suitable for such a writing mode are used in computer technology too in office systems used for business correspondence.

If a character set in a character generator is to be suitable for proportional writing it must be specially structured, the characters must be placed in the character generator cells shifted to the left. Figure 5a shows the letter "t"

in a cell in the case of evenly divided writing and Figure 5b shows it in the case of proportional writing.

In proportional writing one can cut off, with the parallel-serial transformer, the part of the cell shown in the figure with cross-hatching so that the video line information for the next character is loaded into the parallel-serial transformer when only the cross-hatched part will be "stepping out" in the stepping register. The 4 bit width information coming from the character generator helps here, it gives the width of the uncross-hatched part of the cell where the character is.

A character set structured for proportional writing can also be used for evenly divided writing because the microprocessor is capable of dividing the cross-hatched part into two parts of equal width and putting them before and after the part of the cell containing the character, thus "drawing" the character to the middle. It is a condition for this that the character should be in the middle of the cell part containing it in regard to its horizontal position. So there is no need for a character set structured on the basis of even division if there is a character set suitable for proportional writing.

Italic Writing

The video processor produces italic writing by electronic slanting of the "straight" characters. Two special inter-word characters are used to start or stop italic writing (see Figure 6).

These change their width size depending on the video line of the cell, corresponding to one pixel per four video lines. Their height is adjusted to the cell height value of the character set being used. The block designated "a" introduces the beginning of italics and the block designated "b" ends the italic writing. It can be seen that after "a" characters which would be straight will slant and after "b" their straightness will be restored. This method gives slanted writing of about 75 degrees.

Variable Width Between Words

Proportional writing brings with it a need for text justification. A variable width between words is a tool suitable for this. Making use of the interface processor and page memory the computer can give variable inter-word widths instead of or in addition to the normal ones. Thus the ends of lines can be ordered in a vertical line. The largest width of a variable width inter-word is 256 pixels. The video processor provides this service by sending "white pixels" and by counting; the character generator does not take part in this.

Changing Print Line Distance

The smallest value of the printing line distance coincides with the vertical size of the character generator cell. But the line distance can be increased by inserting "empty" video lines. The video processor is capable of this. A page memory instruction pertaining to this is given in the byte of the end of line character containing supplementary information. Giving a white color on the video interface can be done by counting video lines.

Summary of the Services Realized With the Video Control

BSI parallel interface;
Basic command code set coincides with that of a line printer;
In the base condition (after being turned on) the horizontal and vertical writing density coincides with the customary values for line printers (horizontally 10 characters per inch, vertically 6 lines per inch). In this case one gets a maximum of 66 lines of 80 characters on an A4 page;
A semi-graphic character set. Since the cells can touch in the horizontal and vertical direction one can draw continuous lines;
Variable line distance;
Variable inter-word size (SPACE);
Flexible cell size. Can be changed vertically by video point between 1 and 64; horizontally one can have 24 or 32 video points;
Character sets which can be loaded through the interface;
At most four character sets containing 224 characters depending on structure;
One can choose among the available character sets at any time with a command sent through the interface;
Evenly divided and proportional writing. The mode can can be chosen at any time with a command sent through the interface;
Italics. Can be used with any character set. The italics command can be sent and withdrawn at any time;
Left margin can be set by a command sent through the interface;
Margin at top and bottom of page can be changed with a command sent through the interface;
Multiple copy printing without repeated data transmission;
Indication of horizontal or vertical overflow can be authorized or forbidden with a command sent through the interface.

Planned Further Development of the Video Control

We plan the following in the course of the further development of the device:

--A so-called "landscape" writing mode, which means that although the A4 sheet will still pass through the printer in the direction of its longer edges the lines of writing can be parallel to these. (In the so-called "portrait" writing mode, the only one which can be used now, the lines of writing are vertical to the longer edges.)

--Index and exponent writing, which could be done even now by selecting an appropriate size character generator cell with characters placed in it in an appropriate way. At present, however, an index cannot be placed under an exponent. The goal of the further development is to eliminate this limitation.

--Making the interface processor capable of performing end of line justification. At present this task must be done by the computer.

Authors

Istvan Ecsedi. I was born in 1949, in Budapest. I graduated in 1971 from the communications industry section of the weak current school of the Kalman Kando Electric Industry Technical College. I have been working at the Videoton Developmental Institute since 1973. I have been a "printer" since I came here. I have participated in development of almost every Videoton printer. At present I am working on further development of the video control hardware and software planned for the laser printer. I like to read and play sports in my little free time.

Tibor Pojjak. I was born in 1947, in Budapest. I got my diploma in 1970 in the communications engineering section of the electrical engineering school of the Budapest Technical University. Until 1972 I worked at the Orion Radio and Electric Enterprise, as a television developer. I have been a worker at the Videoton Developmental Institute since 1972 where I participated in the development of various line printer models in the 1970's. Since the beginning of the 1980's I have been dealing with control of electrostatic printing equipment. I am married and have two little girls. I spend my free time primarily with my family, with reading and listening to music.

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LAOCON CONTROL SYSTEM OF MTA-SZTAKI

Budapest MAGYAR ELEKTRONIKA in Hungarian No 2, 1986 pp 24-26

[Article by Istvan Rakoczy and Laszlo Frittmann: "The LAOCON Control System"]

[Text] The LAOCON (Local Area Optimized Control Network) is a control system using two modern ideas of computer technology--the principle of local networks and of parallel data processing. The system offers mass manufacturing conditions for manufacturers and flexibility and a significant reduction in the costs of putting it into operation and servicing and in downtime for users.

Introduction

The LAOCON system uses solid state circuits based on a digital electronic microprocessor to perform control, data collection and data management functions. The system can be connected to the input and output devices used in the control technology industry such as limit switches, push buttons, pressure and other sensors, solenoids, valves, coders, decoders, lamps, indicators, etc.

The user can easily program the LAOCON control system to perform various special tasks. Its applications area is especially broad. Among others it embraces the areas of computer control, material movement, automated data collection, packaging technology, measurement technology, the petroleum industry, the foodstuffs industry, the synthetics industry and the agricultural processing industry, to mention only the most important.

Basic Idea

The hermetically sealed modules of the LAOCON system, protected against electric and magnetic influences, can be installed at a distance from one another. (We call the modules the distributed intelligence microcontrolled output and input modules, or DMC I/O's.) These modules, connected by a twisted wire pair, can form a control system which can be used immediately. The DMC modules can be installed on the machine being controlled in the immediate vicinity of status switches and magnets. The LAOCON is distinguished from control units containing similarly distributed input/output units primarily by the fact that in the case of the LAOCON there is no need for a so-called

central unit or control computer since the several DMC modules "take the place of" the central computer and take over its tasks.

Characteristic Properties

The building blocks of the LAOCON system are modules of pocketbook size made up of the same parts assortment. A system consists of a large number of modules. The mechanical and electrical elements make it possible for the manufacturer to use the technologies of mass manufacture.

Every single DMC module has a computer. Depending on the magnitude of the task different numbers (3-100) of DMC modules can be built into the system, thus the computer capacity of the LAOCON changes as a function of the configuration. The user can program the LAOCON system for a task of any complexity in an extraordinarily flexible language called COLA. Because of these things the LAOCON is perfectly flexible.

The LAOCON system is built up of completely disjointed DMC modules which are entirely self-contained and independent. One does not need control cabinets, racks, line transmitters or receivers, special or long cables or connections. Because of all this putting the LAOCON into operation significantly reduces the material and time cost as compared to traditional controls.

The self-diagnostics of the system are at a very high level. The connection of the DMC modules is loose so it is difficult for a failure to spread between modules. The modules constantly check themselves and the other modules, so the LAOCON discovers and indicates the faulty module with very good reliability.

The few types and cheap price of the modules makes it possible for users to keep spare modules in the warehouse. In case of failure the module indicated as faulty by self-diagnosis can be exchanged even by an untrained person with a simple screwdriver, so there is no need for a service expert and the downtime can be drastically reduced.

A broad assortment of LAOCON modules is available for users. Among others there are 24 V DC outputs and inputs, 220 V AC outputs, analog outputs and inputs, modules realizing the man-machine link and a speech synthesizer module.

System Operation

The LAOCON is a distributed modular control system both physically and logically. A typical system might consist of a storage module and a few input and output modules. The same or different modules can be mixed with one another as you like. A serial communications network (the LAOCON bus) links the several modules with one another; we use normal twisted wire to build up the network. In the LAOCON communications protocol we protect the transmitted data with parity bits and CRC, which offer perfect protection with the hardware solutions used. Through this communication line each module can access the variables and physical inputs and outputs of all the other modules. The speed of information exchange between modules is 10 K baud.

Each module is made up of two circuit cards (a control card and an input and output card). The control card is the same in each module; the I/O cards differ depending on the function to be performed by the module. The control card contains a general purpose 8 bit CMOS microcomputer and the LAOCON bus connector. In the storage module the I/O card is a special one and performs two tasks. On the one hand, after it is turned on, the EAROM (electrically rewritable memory) distributes the user program stored in memory among the several I/O modules. After the program distribution operation each I/O module stores and executes its own part of the user program, designated for it, and carries out its own I/O operations. On the other hand the storage module maintains contact with the development system through an RS-232-C serial line. On this line the user can intervene directly in the LAOCON system. (He can load a program or influence the operation of the system.)

Module Assortment

The desired modules can be chosen on the basis of the table in accordance with the given function.

Module Type	Function
DMC-STORE	storage
DMC-DCIN	8 direct current digital inputs
DMC-DCOUT/L	8 direct current digital outputs (low current)
DMC-DCOUT/M	8 direct current digital outputs (medium current)
DMC-DCOUT/H	8 direct current digital outputs (high current)
DMC-ACOUT	8 alternating current outputs
DMC-AIN	8 analog inputs (8 bit resolution)
DMC-AOUT	8 analog outputs (8 bit resolution)
DMC-MMI/L	man-machine interface (keyboard, indicator)
DMC-MMI/S	man-machine interface (keyboard, CRT)
DMC-SPEECH	speech synthesizer

Programming

In the course of user program development one can connect to the storage module a domestic or other personal computer (program development station) running under a CP/M or DOS operating system (Apple, Kaypro, Osborne, IBM XT, etc.). A constant link between the storage module and the PC is not absolutely necessary; this is needed only when writing and testing the user program. The task of the program development computer is to aid the work of the user. As could have been seen, the LAOCON system uses a number of computers when in operation and these work at the same time, parallel with one another. The program development computer makes this parallel data processing "disappear" and so the user can program the LAOCON as if he were using a single computer.

Program Development

The user can write the control program (user program) for the given machine in the COLA (Control Language) language in a very free format. The text editing program of the PC being used at the time (Wordstar, Edlin, etc.) can be used when writing the user program. A COLA program can consist of any number of

blocks. The blocks can be assigned optionally to the several modules. Those blocks which the user does not assign to modules are distributed among the several modules by an automatic distributer on the basis of a heuristic so that the reaction time of the system should be as minimal as possible. After distribution the user can load the user program into the memory of the storage module. In order to discover errors in the program the developmental system has a monitor mode, during which the loaded program can be started, stopped and continued in the IAOCON system. With the aid of the developmental system the variables and registers of the operating IAOCON system can be queried and their values or contents written out. A relocating assembler and linker and a simulator help the user in writing his own machine code routines.

The Control Language

The individual blocks consist of program lines. One can refer to the lines with labels. The lines can be remark, definition and instruction lines. With the definition lines one can assign the logical identifiers used in the program to definite channels of the physical system. The program lines can contain various instructions, the operands of which can be variables (bit values), registers and constants. There are several groups of instructions:

--instructions determining blocks,
--definition instructions,
--conditional and unconditional jumps,
--instructions pertaining to variables,
--instructions pertaining to registers,
--function calls.

The instructions pertaining to variables actually define storage and transfer type connections, in addition to several instructions of Booleian algebra (logical and, or, parentheses, negation, etc.). With the instructions pertaining to registers one can load the registers with values, sum them with one another, subtract, compare and use them as timing elements. With the jumps one can realize branches in the program. It is a characteristic of COIA that it allows the user to prepare and call machine code routines for any purpose within the user program. For the MMI and SPEECH modules, naturally, there is a routine package available which the user can use. With the aid of the routine package one can read in from the keyboard any numerical values or text or can display these at a given place with the indicator.

The following sample program writes out into position X=10, Y=15 of the screen the temperature indicated by register R20 if the variable 100.5 is true or if the variable 10.1 is false. If the temperature deviates from the limit value (210) then it writes the text "EXCESS TEMPERATURE" in position X=10, Y=16.

[Note: In the original the program appears as a mixture of English (COIA) and Hungarian; the Hungarian portions of the program have been translated below.]

```
B1                          #BEGIN BLOCK
Y100.5 + N10.1              #CONDITION TEST
CALL NUMOUT (10; 15; R20)   #WRITE OUT TEMPERATURE
R20 210CJ:WRITEOUT          #LIMIT VALUE TEST
```

```
J:CONTINUE
$WRITEOUT
CALL STINGOUT (10; 16;              (10; 16;
  "EXCESS TEMPERATURE")=
  WRITE OUT LIMIT VALUE
$CONTINUE                        #END OF BLOCK
```

Authors

Istvan Rakoczy. I was born in Budapest in 1950. I graduated from the electrical engineering school of the BME [Budapest Technical University] in 1974. After university I was placed in the MTA SZTAKI [Computer Technology and Automation Research Institute of the Hungarian Academy of Sciences] where I was occupied with research on and development of machine tool control equipment (CNC). At present I am leading the work of the group dealing with the LAOCON control system.

Laszlo Frittmann. I was born in Soltvadkert in 1952. I graduated from the electrical engineering school of the BME in 1976. After completing the university I worked at the SZIMFI [Developmental Institute of the Machine Tool Industry Works] and then went to the MTA SZTAKI, where I dealt with industrial controls. At present I am dealing with the LAOCON control.

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DEVELOPMENT OF ROBOT CONTROLS AT MICROELECTRONICS ENTERPRISE

Budapest MAGYAR ELEKTRONIKA in Hungarian No 2, 1986 pp 42-47

[Article by Lajos Ocsai: "Development of Industrial Robot Controls at the MEV"]

[Text] Introduction

The Gyongyos factory of the Microelectronics Enterprise began to deal with the development and series manufacture of industrial robots in the second half of the 1970's. In 1978 it was decided to solve the control of some products electronically. The factory has very favorable conditions from the viewpoint of electronic development because:

--it has talented developers and experts for the manufacture of integrated circuits,

--its product structure and market possibilities are favorable for internal use and large series sales of electronic systems (glass industry and packaging technology equipment, semiconductor manufacturing equipment, industrial robots and manipulators, etc.),

--it is itself a manufacturer of electronic parts. In addition to easier parts acquisition the sale of its own parts and their use in complex products might be a factor increasing enterprise profit.

As a result of the above possibilities MEV Gyongyos became one of those factories for which microelectronics became indispensable in its production and in its products.

First Generation Controls

The first control made of SSI-MSI elements proved the unambiguous advantages of an electronic solution. But it also became apparent that only the manufacture of a flexibly useable, microprocessor, very carefully modularized control family could bring significant results.

In 1979, surveying the domestic status of computer manufacture and control equipment manufacture, we began development of a microprocessor, modular control family. The microprocessor chosen was the INTEL 4040 four bit microprocessor. As of 1983 we had prepared more than 200 units from this control family for various mechanical devices and had shipped most of them to Soviet users.

Because of the swift increase in the price and acquisition uncertainty of four bit microprocessor elements we switched to use of 8 bit microprocessors.

A Modular 8 Bit Microprocessor Control System

Taking into consideration the swift development of microelectronics, the development of domestic possibiities, the changes in demand accompanying technological development and the experiences acquired with the earlier equipment containing microprocessor controls we developed the new M8B module system. The theoretical structure of the system can be seen in Figure 1.

From the applications technology viewpoint the most important modules of the system are the following:

M8B-CPU Module

The M8B-CPU module is the central unit of the system connected to the M8B coupling bus; it is based on the Z-80 microprocessor. The memory capacity attainable can be a maximum of 16.5 K bytes as a function of the type of memories used. In addition to the circuits needed to operate the microprocessor the module also contains an input/output circuit (MK3883CTC). The most varied delay and counting operations may be needed for control tasks for the mechanical devices attached to the control. With the aid of the programmable counting-timing circuit these functions can be realized easily without use of time consuming program loops. The CTC takes care of the counting and timing tasks occuring in the system under the supervision of the software.

The central unit is connected to the system bus with the aid of the interface. The task of this circuit unit is to separate the lines of the microprocessor and drive the lines of the system bus.

The internal structure of the CPU module can be seen in Figure 2.

M8B-PIO Module

This module takes care of data transmission between the microprocessor and the various peripherals. The unit contains three MK 3881 Z80-PIO circuits which provide the user with six 8 bit programmable I/O ports, with two I/O data transmission management-control lines per port.

If the given task requires fewer ports we can reduce them with a partial building of the card. The block diagram of the PIO unit can be seen in Figure 3.

M8B-BIO Module

The M8B-BIO is the bit oriented input/output module of the microprocessor system. It serves as an interface between the byte organized M8B-CPU and the bit organized system peripherals (such as panel or final position switches, push buttons, etc.). With use of the BIO module the software routines serving the one bit system peripherals can be shorter and more efficient.

M8B-AMP Unit

The AMP module is the output driving module of the M8B system. Its task is to amplify the signals generated by the PIO and BIO modules to the desired level, and galvanic isolation of the control and executing parts. It makes it possible to break up the outgoing signals with the aid of the modulating input. Sixteen output lines can be connected to one modulating input.

The individual lines are protected against short circuit. The value of the current limitation can be set between 300 mA and 1 A. A protective diode at the output drains the surges arising in the event of an inductive load. The module can also be assembled without galvanic isolation. The block diagram of the unit can be seen in Figure 5 and its circuit diagram can be seen in Figure 6.

M8B-SNS Unit

The task of the SNS module is to create a link between the various signal generators and status sensors and the input ports (the designated points of the BIO and PIO modules).

One can find 32 line sensors on the SNS module; these are divided into four 8-line groups.

The line receivers are suitable for accepting DC and AC signals. Its block diagram can be seen in Figure 7 and its circuit diagram can be seen in Figure 8.

M8B-KYB Module

This is the universal keyboard and display module of the M8B system. It has an eight character indicator unit and a push button keyboard. This module creates the link between the user and the control.

A block diagram of its operation can be seen in Figure 9.

In addition to the above we have developed a number of modules for the system which solve an individual given task (for example, the M8-SXB-24 output line and input line).

Various mechanical devices (handlers, packaging machines, etc.) can be controlled by using these modules. The controls for the fixed, right angle coordinate system and cylindrical coordinate robots manufactured at Gyongyos are made from elements of the M8B system. A possible application can be seen

in Figure 10. For example, such a control can be found in the MTE55 model reloading robot.

The robot has five axes and is capable of positioned movement only in the final positions; thus the control can be realized by using a minimal module. The robot can be taught through the KYB module. In Hungary we have installed such a robot to serve a casting machine at the Satoraljaujhely factory--now independent--of the ELZETT.

Multiprocessor Controls

The development of a system suitable for control of articulated robots was completed this year (Figure 11).

The central part of the control electronics is a microcomputer which consists of the following elements: (1) central processor, (2) serial interface, (3) memory with system program, (4) user memory and (5) parallel interface. The following devices can be connected to the system through the serial interface: (7) a video terminal as a device to maintain contact, (8) a floppy disk unit as program storage and (9) a teaching unit controlling training and hand movement.

The above microcomputer within the control electronics supplies tasks to the microprocessor control cycle for every moved axis of the robot arm. The link between the two systems is realized through the interface stage (6).

The control cycle (servosystem) consists of digital and analog parts built up independently for every motor. The digital part is a Z80 based microprocessor unit. A final stage (11) is connected to the output of the analog stage; it amplifies the low level control signal to the required current and voltage level. Depending on the power of the motor to be driven the final stage has analog or switch operation. Units (15) and (16) supply power for the control circuits and final stage. The fewest possible switches, push buttons and LED indicators constitute the operating organs of the front panel. The executing part (the mechanics) are connected to the control electronics through the main coupler (12).

We developed the control electronics primarily for the articulated robots but they are also suitable for carrying out control tasks for other electrically driven (DC motor) portal or reloading robots.

Author

Lajos Ocsai. I was born in 1949, in Adacs. I began work in Budapest in 1972 as an electric instrument maker at the Communications Engineering Cooperative. I obtained my degree in 1980 at the electrical engineering school of the Budapest Technical University. In 1981 I went to the Gyongyos factory of United Incandescent, as a developmental engineer. At present I lead the electronics main department of the Gyongyos factory of the MEV. The tasks of the main department are designing controls for robots and other mechanics and product engineering tasks for the manufacture of integrated circuits.

FIGURE CAPTIONS

1. p 42. Structure of the M8B system.

2. p 43. Internal structure of the CPU module.

3. p 43. Operational block diagram of the PIO unit.

4. p 44. Functional block diagram of the BIO.

5. p 44. Operational block diagram of the AMP unit.

6. p 45. Circuit diagram of one line.

7. p 45. Operational block diagram of the SNS unit.

8. p 46. Circuit diagram of one line.

9. p 46. Block diagram of the KYB unit.

10. p 46. Block diagram of the MTE55 robot control unit.

11. p 47. Operational block diagram of the "Robot Controller."

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INNOVATIONS AT GANZ ELECTRICAL WORKS

Budapest MAGYAR ELEKTRONIKA in Hungarian No 2, 1986 p 73

[Unsigned article in the "We Have Only One Question" column. The respondent is Dr Jozsef Viragh, director general of Ganz Electric. It should be noted that in the original the old name of the enterprise was "Ganz Villamossagi Muvek" while the new name is "Ganz Electric," requiring no translation.]

[Text] [Question] At the beginning of the year we could often see the announcement: "A firm with a great past is renewing itself. Beginning 1 January 1986 the new name of the Ganz Electrical Works will be Ganz Electric." It is probable that the new is represented not only by a change of name, so our question is: What is new down deep, with special regard to electronics?

[Answer] Abraham Ganz founded the first Ganz factory, an iron foundry, in 1844. The firm could attribute its swift development to the fact that it was always receptive to technical innovations. It was in this spirit that the first electric department of the factory was created, in 1878, when heavy current electronics were largely only a laboratory theme. This shop and the Ganz Electrical Joint Stock Company which became independent produced, by the turn of the century, such world famous novelties as a transformer power distribution system and the first electrified main rail line in Europe.

For a short time after World War II the factory functioned as the Klement Gottwald Electrical Factory, then, as of 1964, the Ganz Electrical Works was formed which included, in addition to the parent factory in Budapest, the Obuda Apparatus Factory and other independent factories in the provinces.

The firm produced increasingly significant export beginning in the 1950's. Progress in the area of developed technology is indicated, for example, by a Ganz license purchased by world class firms in Sweden and France and by the organization of heavy current electronics manufacture.

In the short time of its existence this manufacturing branch has gone through a noteworthy development. Originally it was founded to supply to the traditional products (large alternators, giant and special transformers, high voltage devices, electric vehicles) the auxiliary electronic equipment now indispensable for market sales. Having met this task successfully more and more "byproducts" were developed which were quite profitable with little extra

investment; it turned out, in regard to equipment created for main manufacturing purposes, that they could be used in many areas outside the previous profile and might be sold as independent products. Thus it was in 1974 when the factory decided to take over manufacture of railroad safety equipment.

Since then the Electronics Factory Unit has gotten a new, modern shop. Among other things it has started manufacture of industrial process control and process supervision systems. For example, the GVM '85, which won the grand prize at the Budapest International Fair, is being used to supervise the South Balaton single-track two-direction rail line and is being used at the Komarom waterworks. A further developed version of it will be suitable not only for supervision but also for control from a single dispatcher center of the Szentendre line.

In 1985 we organized the manufacturing branch into an independent vertical branch under the name control technology branch. In this organization not only the designers but also contracting and marketing go directly together with the producing units and constitute with them a common self-accounting unit. In this same year the convertible export of the branch began, for the time being with railroad safety equipment to Finland

With this step electronics has taken its place among the successful manufacturing branches of the large enterprise. This is no small matter, for the level of the traditional profiles is stamped by such products as the turbogenerators, transformers and other electric equipment for the Paks Nuclear Power Plant, the Albertirsa 750 kV transformers and 420 kV sulfurhexafluride encapsulated switching equipment (we were the first among the socialist countries to realize series manufacture of these at such a high voltage level), the modern electric locomotives which may use modern electronics to the greatest extent, the 50 Hz main line motortrains shipped to Yugoslavia and Tunis, the highway tramcars in Alexandria which broke the Japanese hegemony and the "chopper" trolleybuses being exported in ever larger numbers. Nor can we leave out of the list the new Budapest metro car the electronics of which result in a 25 percent energy saving as compared to the very well proven but older design Soviet cars.

The enterprise has an independent right to export its modern products. Despite this it continues to make use of the cooperation of the foreign trade enterprises on all the traditional markets. The significance of export expansion directed toward new markets is well shown by the fact that two thirds of the 1986 convertible export is based on contracts signed in our own right. The newly assumed name "Ganz Electric" will also serve these market goals better than before.

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CAD-CAM RESEARCH AT COMPUTER TECHNOLOGY, AUTOMATION INSTITUTE

Budapest MAGYAR ELEKTRONIKA in Hungarian No 2, 1986 pp 74-75

[Article by Tamas Varady, chief of scientific department: "CAD-CAM at the SZTAKI"]

[Text] One of the stressed research themes of the Machine Industry Automation Main Department in the Computer Technology and Automation Research Institute of the Hungarian Academy of Sciences is computer aided design and manufacture (CAD/CAM), the nucleus of which is made up of the linking together of mathematics, computer graphics and numerically controlled machine tool programming. Cultivation of the theme can already look back upon a past of more than 10 years; valuable international publications, dissertations, international scientific cooperation, special systems adopted for domestic industrial enterprises, prototype systems and software systems in commercial trade stamp the activity of the research staff. Going beyond theoretical basic research the sphere of applications is very broad--robot animation, computer aided technical drawings preparation, design and grinding of glass models, design and working of complex bodywork elements and forging and synthetics casting tools and so forth.

A representative example of the linking together of the disciplines listed above is the FFS (free form shapes) system which serves computerized design and working of so-called free form surfaces. Such surfaces bound a significant part of the objects around us. Let us think, for example, of a telephone receiver, an automobile body, a plastic flask or a complex casting. It is characteristic of all the above objects that from the geometric viewpoint they are defined by complex "free form" surfaces difficult to define geometrically, in addition to simple plane, cylinder, cone and sphere surfaces. Because of the above properties these surfaces are often called sculpturesque surfaces.

An exact definition of such surfaces is very cumbersome, it would often be impossible without using the apparatus offered by computerized geometry. In the FFS it is enough to give a few characteristic points or possibly section curves and the system stretches a mathematically and esthetically smooth surface over the geometric data given. With the aid of the figure appearing on the graphic display the designers can check the correctness of their ideas and if necessary modify the surface in the interactive mode. By putting such surfaces together one can describe very complex parts or tools which can be

manufactured with the aid of the NC processors of the FFS on the basis of the data stored in the computer. Numerically controlled machine tools do the working automatically with great precision.

It is hardly necessary to explain how use of the computer increases the efficiency of the process from production to manufacture. The FFS system is used to solve a number of practical tasks, primarily in the area of tool manufacture. A number of leading Hungarian industrial enterprises use or intend to use the system. These include the Machine Tool Factory of the Csepel Works, the Machine Tool Industry Works and Ikarusz. Within CEMA also there is lively interest in the system and a number of sales are under way.

At present the FFS runs on PDP (TPA) 11-40 or compatible computers under the RSX-11M operating system. The system is easily adapted to various graphic displays and plotters and can be adapted easily to the control equipment of various NC machine tools.

The GRECO technical drawing system has been prepared for the same TPA 11-40 environment. It serves the computerized description of high complexity drawings. A characteristic example of this is the attached drawing of King's College Chapel (Cambridge).

A number of exciting research and development projects are under way at the Machine Industry Automation Main Department. We are gradually adapting our existing systems to professional personal computers or to graphic work stations based on the 32 bit VME bus microcomputer. Systematizing the new theoretical achievements of computerized geometric modeling, using new modeling techniques and spreading these methods will in the near future contribute increasingly to the modernization of our industrial structure.

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MEGAMIKRO: SPECIAL SERVICES FOR CUSTOMERS

Budapest MAGYAR ELEKTRONIKA in Hungarian No 2, 1986 p 76

[Article by T. K.: "Unit and System"]

[Text] In February of last year the MEGAMIKRO Computer Technology Informatics Service Small Cooperative was formed with 18 former KFKI [Central Physics Research Institute] experts. There are now almost 50 full-time workers in the cooperative and their main job is testing and putting into operation the 150 TPA Quadro computer systems ordered from the KFKI.

Miklos Szalai, technical leader of the cooperative, said that the KFKI chose well when it began development of the PDP compatible computers, demand for them is very great today. The TPA Quadro is a multi-microprocessor device in which different processors handle the display, the peripherals and the CP/M operating system. The computer is manufactured by the Servintern Industrial Cooperative. In addition to putting them into operation MEGAMIKRO undertakes to prepare the customers and satisfy special needs. It has turned out that almost every user has special needs which cannot be satisfied from the domestic market. For this reason they have begun to deal with hardware development and manufacture too. For example, they have prepared an intelligent microprocessor graphic display which can be connected not only to the TPA but to other computers as well. They have also developed subassemblies which, with high resolution and flexible programming ability, make it possible for the computer to display analog processes or to intervene in them.

According to the plans of the cooperative they will start by developing the subassemblies and manufacturing them in small series and only later do they plan to deliver systems. At present, within the framework of a contract involving a large sum, they are developing further the ICOMAT series of the Microelectronics Enterprise. They are preparing a Winchester store subsystem for another customer--accompanied by great interest.

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BUDAPEST TECHNICAL UNIVERSITY DEVELOPS UNIQUE INSTRUMENTS

Budapest MAGYAR ELEKTRONIKA in Hungarian No 2, 1986 p 76

[Article by T. K.: "Electronic Instruments"]

[Text] Instrument development based on their own basic research is taking place in the general and analytical chemistry faculty of the Budapest Technical University. The goal of the research group, led by Adademician Erno Pungor, is to show that the purchase of licenses is not the only saving solution. The results of basic research at a suitable level can be competitive even in the international field.

Time has already justified the experiments. A final product of research thus far is a new material which makes possible the direct measurement of potassium in blood and other organic materials. A single kilogram of the material is worth 200,000 dollars today. The Japanese Horiba firm wants to purchase the license for the special electrode for 280,000 dollars.

From such foundations they started instrument development supported by the OMFB [National Technical Development Committee]. The experts have developed five new instruments all the way up to the ability to market the know-how. Each device is based on modern signal processing and their electronics are compatible with those of instruments used in the West. The development of a high sensitivity electrochemical detector is accompanied by lively foreign interest. The equipment can be used in high pressure chromatography and makes possible the quantitative measurement of organic materials on the order of a picogram.

The oscillometric microdetector measures the conductivity of materials in such a way that the solution has no direct contact with the electrodes. The device contains a special high frequency oscillatory circuit, a signal amplifier and a balancing circuit. A computer controls the microelectrode calibrator and aids evaluation by taking voltage signal samples. It is suitable primarily for biological studies. The macroelectrode calibrator is similar but it offers advantages primarily to electrode manufacturers because it makes calibration possible in a short time, with little material and safely. The flow-through potentiometric measurement system can be used for fast analysis jobs.

There are already prospects for good business in the case of the first two instruments. The faculty has built its own little know-how plant where small series are manufactured. Developments also extend to automatic series analysis analytical equipment for environmental protection.

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DEFECTOPHONE: KFKI DEVICE FOR NON-DESTRUCTIVE EXAMINATION OF MATERIALS

Budapest MAGYAR ELEKTRONKIA in Hungarian No 2, 1986 pp 82-83

[Article by Andras Liptak and Janos Gereb: "The Defectophone"]

[Text] Introduction

The Central Physics Research Institute (KFKI) recently began manufacture of a non-destructive material testing instrument called the Defectophone which it developed itself. The portable microprocessor instrument uses acoustic emission analysis, a so far little used but swiftly developing method of non-destructive material testing technology, to classify the tested object.

The essence of the method is that structural changes accompanying the deformation of solid materials are accompanied by sound emissions. In some cases these sounds can be heard well even by ear--let us think for example of the vibrations accompanying a load on a structure built of wood--but at other times they can be recorded only with the aid of sensitive instruments. It is true in both cases however that from the parameters of the effects we can come to conclusions about the structural changes causing the emissions and thus about the state of the object studied.

The sound waves produced by the faulty spots can be detected in the material even at a distance of several meters. With the aid of a few piezoelectric detectors it is possible to check the entire volume of a large object at one time so that significant time and cost savings can be attained, for with traditional methods (such as ultrasonic tests) the entire surface must be examined point by point.

During acoustic emission measurements the object studied must be loaded mechanically or thermically because the structural changes going with the sound effect arise as a result of loading.

Chief Aspects of the Design

The Defectophone is the newest product of the KFKI's acoustic emission instrument development program. A 32 channel measurement laboratory, built into an autobus, was developed earlier to satisfy serious scientific demands; then a need appeared for a marketable portable instrument which would make the

achievements of theoretical research available to practical experts. The robust design, simple operation and network or battery mode of the 4 channel Defectophone fit in well with the needs of factory practice.

For some measurement tasks the processing of data makes necessary computer technology apparatus at such a level that it cannot be built into a small portable instrument at this time. In such cases the Defectophone can operate as an intelligent data collector, storing the measurement results in the memory module. When the measurements are completed the memory module can be pulled out of the instrument and the data thus easily transferred to a processing computer suppled with peripherals. It is also possible for the Defectophone to communicate with a computer directly--during or after the measurement--via an RS-232C standard serial line.

The Hardware

Piezoelectric detectors fastened to the surface of the object studied transform the sound waves into electric signals. These signals, in a frequency range of about 100kHz to 1 MHz and embracing a dynamic range of about 90 dB, go to an amplifier with a logarithmic characteristic. Since the low level signals of the sensors cannot be conducted a great distance the amplifiers are placed in special boxes in the immediate vicinity of the detectors. The device can process the signals of four such channels at one time.

The data measured by the Defectophone can be of the continuous or "burst" type. The "burst" type data describe the characteristics of individual acoustic emission impulses, such as peak amplitude, time of occurrence, etc. This includes the time differences at which the sound waves reach the several channels, which makes it possible to determine the location of the fault.

The continuous data include background noise and an optionally selected environmental parameter value; these can be measured at intervals which can be set independent of the acoustic emission activity.

Circuits based on a Z-80 type microprocessor collect, digitize and store the measurement data. A memory module with a capacity of 18 K bytes stores the data; it can be pulled out of the device as its built-in batteries make it possible to preserve the information.

The Defectophone communicates with the user with the aid of a liquid crystal display and a matrix layout keyboard. The device can be connected directly to an outside computer through a Z-80 SIO. It is an advantageous service that when using the Defectophone without a computer it has its own plotter output. It is especially useful in the case of series measurements that at values of acoustic activity which can be programmed in in advance the device gives an alarm which can significantly simplify evaluation of the results. When designing the circuits it was an important goal that they require little power for in field applications the device operates from batteries. For this reason the digital circuits--with the exception of the processor--are made of CMOS integrated circuits.

The Software

A 12 K byte program written in the Assembly language running on a Z-80 microprocessor controls the operation of the Defectophone. Considering the small speed requirements the hardware is relatively simple and so the software takes care of a significant part of the tasks. The software takes care of the interrupt requests of the hardware with the aid of five routines.

The chief tasks of the software are to determine and store the values of the continous and "burst" type parameters to be measured, to filter out the invalid data and to operate the interfaces and front panel.

Because of the many operating modes and setting possibilities of the Defectophone the designers turned special care to the most convenient and most easily reviewed solution for programming the device. The matrix layout keyboard meets this task well. The memory module automatically stores the setting of the Defectophone, thus the programming process need not be repeated later, for the memory preserves the information even after being turned off.

In addition to the real-time processing of the measurement results done on the processor built into the Defectophone there may be a need in some cases for a further analysis of the data collected. A typical task, for example, is localization of faulty areas or the generation of amplitude distribution functions. Such a subsequent processing program package has been developed by the KFKI for the Commodore C-64 and the IBM PC personal computers, but one could also use for this purpose any computer which has an RS-232 serial interface.

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MORE SCIENTIFIC RESEARCH NEEDED FOR ROMANIAN ECONOMY

Editorial Comment

Bucharest REVISTA ECONOMICA in Romanian No 16, 18 Apr 86 p 16

[Text] The strong emphasis on the intensive aspects of the development of the national economy at the present stage and in the future, is inseparably bound with the adoption of the most advanced achievements of modern science and technology. In this extremely dynamic and varied area, research depends on production demands through complex relationships. That is why greater efficiency for the solutions offered by research--a primary premise for economic progress--can be sustained in practice only by observing these relationships and understanding the specific nature of the research-production relationship in various branches. Starting from these considerations, we asked some researchers who work in the automation equipment, machine construction, and construction materials industries, for their opinions regarding ways to improve the quality of the solutions offered by scientific research.

Computers in Automation Research

Bucharest REVISTA ECONOMICA in Romanian No 16, 18 Apr 86 p 16

[Article by Aristide Predoi, director of the Institute for Automation Design: "Improvements Needed in Product Design"]

[Text] As we know, the rates of development of electronics and automation as a whole are higher than those planned for the other industrial branches, while the Directives of the 13th Party Congress have established that the production of the electronic, computer technology, and automation industry, under the influence of microelectronics, will have the highest growth rate, namely 162-167 percent in 1990 compared to 1985. The importance of these objectives is heightened by the tasks to increase labor productivity, improve organization, and standardize production and labor.

It is clear that greater growth in the labor productivity of all sectors of socioeconomic activity--with priority development in the production of components, means of automation, as well as industrial and professional electronic equipment--depends primarily on the manner in which those of us who are active in this area of research and development, approach and solve ahead of production, the fundamental problems of technology and quality, correlated with productivity and economic savings, from the standpoint of lower consumptions of materials and energy. For research in automation, this requirement is even more stringent, since this research must come before research in other fields.

Consequently, in order to assure an average automation of 70 percent in 1987, research and projects associated with it must already be completed in 1986. Starting from the tasks established by the 13th Party Congress, to assure that over 90 percent of 1990's products are of world class, it is necessary that more than 25 percent of the products reach this level as early as this year, and that 1.2-1.3 percent of the products exceed world competitiveness levels, so that by 1990 this cumulated percentage will form an effective production basis.

It should be mentioned in this respect that the implementation of these planned objectives imposes a sustained support of automation in our activities, as a condition for expanding advanced technologies in other economic sectors. In practical terms, this year we will work on computer-aided design in all research and design activities, after which our procedures will be transferred to the research collectives of enterprises of the Industrial Central for Automation Equipment, namely Automatica, the Electrotehnica and Electromagnetica enterprises for automation equipment in Bucharest, the Enterprise for Automation Equipment in Cluj-Napoca, and so on, all of which will reduce the research-production implementation cycle by a minimum of 30 percent. Adding to this the generalization of computer-aided automatic testing using data banks to design the entire range of printed circuits for electronic components intended for automation, computer technology, telecommunications, remote mechanical devices, and remote handling, the engineering control activity will be reduced by an estimated minimum of 25 percent, and will be redirected to research-implementation to increase the rate at which new products are transferred to production.

To these must also be added the computer-aided installation of components on circuit boards, which together with robotized automatic testing, will lead to a productivity growth of 20-40 percent. In turn, computer-aided remote diagnosis and repair defines a new style and spirit in global, integrated research, while basing automation on computers places the emphasis on software, which unlike hardware, is not subject to wear or physical deterioration, and does not require the consumption of materials and energy in production.

There is no doubt that production enterprises will gain significant advantages by adopting in their activities the solutions developed by research for remote diagnosis and testing, so as to assure the most comprehensive services to

users. We believe that only thus will it be possible to efficiently bring the activities of producers into future society and a computerized industrial environment. This aspect is made more relevant by the fact that throughout the world, complex computer, communication, and telecommunication equipment will acquire values which according to some estimates will be of the order of $60 billion in 1987, tending to reach more than $100 billion in 1990, when remote service through satellites will become a daily reality.

Scientific Background for Technology

Bucharest REVISTA ECONOMICA in Romanian No 16, 18 Apr 86 pp 16-17

[Article by Ion Crisan: "Scientific Foundations of Technological Development"]

[Text] The managements of the best enterprises have gained valuable practical experience in the introduction of technical progress, experience whose consistency has been proven in technical successes of domestic design in our machine building industry. But as the goals that face us come closer to the cutting edge of world technology, which is itself undergoing an impressive evolution, it becomes increasingly clear that the practical spirit mentioned above must be coupled with the ability to handle with the greatest skill and maximum efficiency, the significant potential of scientific research in the service of industry. The functions of scientific research in technical design, which we shall discuss below, represent essential factors for reaching these goals.

The involvement of scientific research in solving technical problems starts with a global approach to the problem. The question with which we are faced can be a product or a process. But the object of the question is not an isolated concept; on the contrary, it belongs to a chain such as process-product-process-product and so on, whose links are interdependent. The answer to the question must thus not be limited to the link covered by the question, but must assure the final purpose of the technical system that must be created.

We will use robotics as an example of advanced technology. The user requires a robot with certain specifications for a given operation. The analysis of the requirement must in fact represent an analysis of the system in which this robot will operate. This procedure will disclose that in addition to the robot itself, the system needs a number of interfaces, of connections between the robot and other components of the system. Similarly, it will define various characteristics of the robot, such as sensors, transducers, grasping devices, and working tools. Only on the basis of such a system analysis is it possible to fully evaluate the problems that must be solved, as well as the necessary power, phases, and time.

What happens if this analysis is neglected? There are several possibilities, with clearly negative effects: 1) the customer receives a robot which it cannot use; 2) the solution time is extended several-fold because the sequential, isolated approach to the question creates so-called "surprizes" during the research; and 3) because inadequate attention is focused on it, the solution does not progress at the desired rate, and the program is abandoned after large expenses have been made.

Another major factor in a scientific approach to technological problems, and implicitly in raising the quality of research solutions, is establishing theoretical foundations. The mathematical description of a requested machine or instrument, with all the demands placed on its various components during operation, constitutes a so-called dynamic model. Dynamic modelling of complex structures has been made accessible by computers, and computer-aided design is now part of the technical resources available to the industry. Our technical research institutes now have the means to use computers in research and design on a much broader scale than in the past. The use of these advanced methods and the transition from static calculation of mechanical structures to dynamic calculations that include thermal stresses, vibrations and noise, speeds and accelerations, and so on, has significantly increased the capability of designers to plan the functional characteristics of products when they are still only on paper.

In order to be efficient however, mathematical modeling must be carried out together with experimental testing. The experimental development stage, the laboratory testing of experimental models, represents an absolutely necessary complement to technological research: physical modeling verifies mathematical modeling. In recent years, our institutes have made progress in obtaining test stands for research on models, where computers reproduce the most complex demands placed on the equipment during operation. A great forward step will be made when mathematical modeling and physical-experimental modeling will be integrated in the same cycle so that the two modeling systems will reinforce each other. In the robot field for instance, we now have several methods for dynamic modeling, but the experimental verification of these methods is still not at a satisfactory level. Under these conditions, the construction of robots with the highest work speeds and positioning precisions still does not rest on a satisfactory scientific foundation.

In economic terms, the utilization of these possibilities is translated in reduced risk during the introduction of new products or technologies into production. It is clear that well-conducted scientific research can make an essential contribution to reduced technical risk. Starting from the premise that solutions exist to solve any problem that may arise, technical risk becomes a measure of time. The final objective of technical research is in fact the preventive detection of such problems, and thus the assurance of most rapid assimilation. But the economic risks that occur during the implementation of new technologies are also under the influence of research efficiency. Experience has shown that mistakes in evaluating investments and production costs, and in forecasting the lifetimes of new products or market possibilities, can be avoided primarily through a scientific approach to technical problems.

Research on Construction Materials

Bucharest REVISTA ECONOMICA in Romanian No 16, 18 Apr 86 p 17

[Article by Mihaela Mihailescu, scientific director of the Research Institute for Construction Materials: "Contractual Relations in Research: Flexible and Efficient"]

[Text] The modern construction materials industry, an essential factor for implementing the huge volume of investments in all branches of the national economy, and for erecting sociocultural buildings and housing in our country, has always had the attention of our party and state leadership. An overview of this industry's development which in 1950 had only 5-6 types of products, foremost among them being bricks and cement, and which now covers 310 groups of products, reflects the creative contribution of Romanian technical knowledge. And that is because the development of the construction materials industry represents not only a rapid quantitative growth, but mainly a significant qualitative step marked by the conception of domestic technologies, and by construction solutions adapted to our country's conditions, on whose basis were designed and built large production facilities.

During the 1981-1985 period alone, for instance, the installation of new products, of modern technologies in units which produce construction materials, resulted in the construction and placement in service of 40 technical research and engineering objective per year, aimed primarily at reducing the consumption of raw and other materials, fuels, and energy, improving the technical and quality levels of products, reducing importations and increasing exportations, and strongly raising labor productivity so as to obtain a significant production growth.

One direction of the specialized research in support of construction materials enterprises is to encourage technical progress by building model units with well defined specialties in the areas of reinforced concrete prefabricated products, fine ceramics for construction, as well as heat, sound, and water insulating materials. The structural organization and modernization measures of the technologies used in these units would then be effectively transferred to all units of similar specialty, so that during the present five-year plan, the technical and quality levels of all products in the construction materials industry will meet the greatest demands made by the intensive development of the entire national economy.

The concrete sector for instance, is pursuing research on concretes with special technical specifications, used in some industrial branches of the national economy. We might add that the results of this research have been implemented in pulping mills for the cellulose and paper industry, which until now were being imported.

Technical research and engineering activities at the institute have devoted special attention to developing materials necessary for the construction of nuclear power plants.

The insulating materials industry will in turn undergo substantial changes during this five-year plan by modernizing its current manufacturing lines, with the construction of melting installations with high capacity vane furnaces, and the recovery of secondary energy resources. The major effect of these modernized solutions will be to reduce energy consumption by 50 percent compared to that of the 1981-1985 five-year plan. Manufacturing lines equipped with cupola furnaces for melting raw materials, will be modernized with new binder recovers and crushing systems, improvements which in 1990 will result in lower material and fuel consumptions.

Currently, all technologies used in the construction materials industry are being examined as candidates for adapting and installing process control computers. In this respect, consistent actions have been taken to establish measures and solutions derived from research and design, which will be applied in model units and other units with modern manufacturing technologies, so that they may be equipped with process control computers. Adaptation and transition to process control computers is in fact creating the qualitative leap needed to transform construction materials production units into units that are fully modernized to the level demanded throughout the world.

The success of the actions taken to improve research, development, and technical progress activities, is also due to improved methods of research planning. In this respect, we believe that contracts for the entire study period of a research topic represents a measures necessary to reduce the duration of the research-production cycle and to rapidly obtain efficient results from research work.

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WESTERN TECHNOLOGY ESSENTIAL FOR POLISH ECONOMIC DEVELOPMENT

Warsaw GOSPODARKA PLANOWA in Polish No 1, Jan 86 (signed to press 15 Apr 86) pp 12-15

[Article by Zygmunt Zytomirski: "Poland in the International Transfer of Engineering and Technology"]

[Text] Poland's participation in the international transfer of engineering and technology varied during the successive stages of the country's socioeconomic development. It depended on the developmental strategy employed in a given period, on the openness of the economy and the importance of foreign exchange, together with the exchange of engineering ideas.

One of the conditions for modernizing the Polish economy at the beginning of the 1970's was that Poland would fully participate in the international exchange of engineering ideas and the international division of labor.

During the years 1971-1979 the share of import of machines and equipment in current prices in total investment outlays gradually grew from 17.3 percent in 1970 to approximately 38 percent in 1979. Despite such a large import of engineering and technology in the 1970's, the technological gap between Poland and the highly developed capitalist countries did not narrow. We must regard this as a kind of paradox, stemming from bad decisions and mistaken execution of these decisions.

The share of imported machines and equipment in total outlays for machines and equipment was too high. This indicator rose from 39.9 percent in 1970 to over 81 percent in 1979, meaning that scarcely 19 percent was domestically produced machines and equipment, installed in new or modernized industrial facilities.

It is the developing countries which have such a low share of domestically produced machines in the installation of new manufacturing capacity. In the 1970's, the share of domestically produced machines and equipment in the CEMA countries was approximately 80 percent, and in the United States it was approximately 90 percent. Even in newly industrialized countries, e.g., in South Korea, this indicator was approximately 52 percent.

The guidelines of the highest party and state echelons closely tied the purchase of licences to the country's socioeconomic goals. This was reflected

in recent legal acts. In these acts emphasis was placed primarily on applying foreign scientific and technical findings only when domestic scientific and research facilities were not able to solve a given problem.

In general, licenses were to be purchased for the following purposes:

--to modernize production and improve its quality;

--to stimulate export;

--to undertake production which would replace the importation of some products, especially from the second payments area [capitalist countries].

Initially it was expected that foreign licenses would facilitate modernization of product design, production processes and their organization, improve the efficiency of research and development work, reduce costs at the various stages of product design and technology, and finally, produce new engineering findings as a result of the purchase of licenses and postlicensing activity. Then further strengthening of Polish specialties and minimization of imports connected with the purchases of licenses was stressed.

The geographic structure of the import of machines and equipment changed. In 1970, 19.9 percent of the total imports of machines and equipment was from the second payments area. In 1975, this indicator showed 52 percent, and in 1980 it fell to 27.1 percent. In 1971, Poland purchased investment goods from capitalist countries at a cost of 1.3 billion foreign exchange zloty, and in 1980 this figure amounted to 5.4 billion foreign exchange zloty. In both payment areas, the purchase of investment goods amounted to 5.6 billion in 1971, and almost 29 billion foreign exchange zloty in 1980.

This import had to lessen the interest of industry and its scientific-research facilities in its own engineering and technology. The result was a very slow growth in the number of patents and efficiency-improvement proposals. The cost to the state treasury of modernization intensified internal weaknesses, caused by a rapid and incorrect, from the standpoint of structure, expansion of specific subsectors.

It was necessary to provide a flow of innovations to those branches of industry which should be developed, but they were delayed too long, as compared with other countries, to be able to recover with the help of our own scientific-research potential. Of significance here was import which would narrow the engineering and technological gap and make it possible for postlicense engineering and technology to expand based on its own research. In the light of the existing needs of the economy, two types of licenses were indispensable:

--licenses for parts and subassemblies useful in the manufacture of many finished products;

--licenses for larger production subassemblies, involving engineering, technology, machines and production equipment and organization, or new production plants.

The choice between purchase of a license and conducting one's own developmental research should be based on a cost-effectiveness analysis, and consideration here should have been given to specialization and the large scale of production, because this was supposed to raise the effectiveness of the undertaking.

One form of taking advantage of foreign innovations was the import of machines and equipment combined with the purchase of a license, or irrespective of its purchase. During 1971-1975 the main suppliers of licenses for the Polish machinery industry were: France, the FRG, Great Britain, and Italy; about two-thirds of the licenses active in 1978 came from these countries. The largest number of licensing agreements were entered into with the FRG.

Approximately 70 percent of the licenses purchased wemt to the electromachinery industry and approximately 27 percent to the chemical industry.

An example of the large influence of a purchased license on manufacturing engineering was the "Polish Fiat." Use of this license made for great engineering progress in many branches of our industry and facilitated the production in a relatively short time, of a modern, for us, automobile. Application of this license was responsible for manufacturing engineering changes in approximately 150 industrial enterprises involved in the production of the 125P Fiat, reporting to seven ministries. Specialization made it possible to integrate the parts and subassemblies produced and to extend the series. As a consequence, this made for better conditions by which technical progress could be implemented and manufacturing costs reduced.

The enterprises had an opportunity to familiarize themselves with the modern production methods of foreign firms and to take advantage of the experience obtained in engineering, technology and work organization.

On the basis of the documentation and equipment obtained, it was possible to introduce changes and improve the manufacture of other products in the scientific and technical facilities. Using only our own scientific and technical facilities, we would not have been able to introduce so many basic changes in manufacturing methods in such a short time.

Because it was possible, thanks to licenses, to obtain such a sudden growth in the level of engineering and technology, it was important for the policy of license-purchasing to determine their influence on the improvement of the production process and on economic results. When demand shrinks for products which are not of the latest design, produced according to obsolete technology at high cost and on low-productivity machines, and when it is not possible to solve this problem with one's own scientific-research facilities, a license must be purchased.

When, based on a cost-effectiveness analysis, a decision is made to purchase a license which would make it possible to significantly raise the level of manufacturing and approach the world level, it is important to maintain this level and improve on the license. Because of the large engineering and

technological gap which has occurred in our industry as a result of the enormous development of science and engineering in the world, we purchased 428 licenses during 1971-1980, whereas from 1945 to 1970 we purchased 217.

But we have made many mistakes in our policy of importing licenses, from the engineering standpoint as well as from the legal and economic standpoint. The mistakes occurred principally in:

--planning and proposing the purchase of licenses;

--the method and scope of defining the conditions embodied in the licensing agreements;

--the insufficient modernity of the technology and design of the products covered by the licenses purchased;

--the application of licenses in industrial practice;

--the insufficient effectiveness of the licenses purchased.

The policy for importing of licenses should be based on a thorough analysis of the needs of the industrial sectors and an analysis of the research capability of domestic scientific and engineering facilities. The end result of the proposals stemming from the analysis should be a program for license purchasing which would give consideration to the development of our own engineering and technology.

Next is the signing of a licensing contract only after its advisability has been evaluated, after an examination of alternatives, whether solutions are available in Poland or in other socialist countries. The licensing agreements entered into by Poland in the 1970's were not always preceded by this kind of analysis. The anticipated engineering life and the aging period of the object being licensed were not very well defined. A study of operational problems was not always made before a license was purchased, and the engineering level of the object of the license was not initially examined at the licensor.

The costs of obtaining a license, as given in the proposal, were often too low, and the scope of the import of machines and equipment, coproduction assemblies and materials, was incomplete. This was intended to show that the purchase of a license will bring savings in foreign exchange. In practice, quite often the actual import was of a much higher level than had been stated in the proposal. On the other hand, anticipated economic results were overestimated and the prime costs given were too low, thus increasing the foreign-exchange effectiveness of the licensed production.

The provisions of the contract pertaining to the advantages and limitations of the both sides depend on their negotiating skills and experience, and on the perceived and anticipated consequences of the agreement being entered into. The conditions of the licensing agreement determine the range and importance of the effects which the specific license gives to the economy, its influence, negative or positive, on the country's research and development work, the development of cadres and the engineering level.

In the contracts which we have entered into with licensors we have sometimes accepted conditions which were unfavorable to us; for example:

--a limitation on the size of production;

--a limitation of export rights;

--an excessive reduction in the time that the agreement was to be in effect;

--high licensing fees.

Nor should we forget that we sometimes deprived ourselves of actual legal safeguards allowing for enforcement of contract penalties in case the licensor did not fulfill his contractual obligations.

Organizations purchasing licenses did not have enough offers to be able to make the right choice. Frequently, foreign trade enterprises were not sufficiently familiar with the licensing market and furthermore had a limited influence on management individuals in matters dealing with the choice of a licensor. The licenses purchased often corresponded to scarcely the average European level, had already been used up by the licensor, were obsolete, and had a short technological life. Sometimes at the very moment the license was purchased its advisability and effectiveness were questionable. The application of the purchased licenses to industrial practice was dependent on the industry's scientific and engineering capability, and often occurred without conducting development work during production. The excessively long period it took to put the license into effect also played a part here. Often the products did not appear on the market until 5 to 6 years after the license was obtained. In industrialized countries licenses produce economic results after 2 to 3 years. We have underestimated the time factor in applying licenses in the investment process and in reaching full production capacity; we have also not given sufficient weight to the problem of product quality.

From the standpoint of the number of patents obtained per 10,000 employed, Poland is in sixth place in CEMA, following Bulgaria, Czechoslovakia, the GDR, Hungary and the Soviet Union.

The lack of real integration between the scientific-research centers and production impedes the innovativeness of the economy in our country. Furthermore, rapid and effective adaptation of the results of research and development work requires a suitable infrastructure, which industry lacks.

Most export of license products was directed to the socialist countries (70 percent of the licensed export production), where it encountered lower technical requirements than on the capitalist markets. Export of licensed products constituted 30 percent of the total value of licensed production.

In turnovers with capitalist countries during 1971-1980, the value of export of licensed products did not cover expenditures for the investment and supply import connected with the licenses. One reason was the inadequately developed coproduction of research and development work. The postlicensing policy, which generally brings average results, gives cause for many reservations.

The right technical measures have not been taken to make good use of the licenses, i.e., to apply them and obtain parameters of production corresponding to the rights obtained through the purchase of the license. During the period the contract was in effect, work on improving the license to eliminate defects in the product and improve its characteristics was not always intensively conducted. The range of involvement in prime development, consisting of the preparation of solutions based on experience accumulated as a result of the application of the license, was too narrow. Postlicensing activity, i.e., improvement, by the licensor, of the licensed product after expiration of the license, was much too inadequate.

We have not made full use of the licenses, meaning we did not take full advantage of the production rights and know-how, stemming from the results obtained through the licenses, to manufacture our own products. During 1971-1980, of 419 licenses, only 49 percent were used for developmental activity, i.e., 205 licenses. Improvements were made and applied on the basis of 120 licenses, and products were exported on the basis of 54 licenses.

It was assumed that in the second half of the 1970's there would be an improvement in foreign patent and license turnovers and in the profit-and-loss statement of these turnovers, but this did not occur.

Work productivity dropped and the ratio of invested capital to production size was unfavorable. The principle of self-payment of credits drawn for import of modern machines and equipment was constantly being violated.

The concept of an engineering and technology gap is used to compare the level of engineering and technology in Poland with the developed capitalist countries. By this concept we mean the difference between the highest world-scale level of development of engineering and technology in specified fields of the economy, particularly in industry, and the level of engineering and technology reached in a specific country.

In economic practice, every shortage of means and resources forces the use of engineering and technology much worse than that employed in developed countries. As a result, the engineering and technological gap continues to widen.

In the electromachinery industry, the main cause of the engineering and technological gap is the lack of sufficient domestic materials.

A large gap separates us from the developed capitalist countries in the technical preparation of production. Already in the mid-1970's the range of modern equipment used in Poland in design offices and in the preparation of production, was similar to the range of tools used in the CEMA countries and the developed capitalist countries. This is not so today. The capitalist countries improved and disseminated these tools, the CEMA countries also made progress in this field, but Poland actually regressed, and very far.

This has greatly affected the level and rate by which new designs and technology are applied to products and the methods by which they are produced.

From the design standpoint, only ships are up to the world level, but the degree of automation of service lags behind.

Automotive equipment is approximately 20 to 25 percent heavier than the equipment produced in the developed countries. The service life of both trucks and automobiles is twice lower. The design of high-compression and gasoline engines being used goes back to the late 1950's and early 1960's and is far from modern. The serious backwardness in manufacturing methods and techniques is caused by the extremely low use of plastic forming, heat treating, and powdered metals technology in the Polish machines industry.

The share of plastic forming machines in the total production of metalworking machines is 10 percent in Poland, 23.6 percent in the Soviet Union, 20.7 percent in Czechoslovakia, 34.5 percent in the FRG, and 23.4 percent in the United States. The automation of technological processes in the electromachinery industry lags greatly. It should be regarded as highly unsatisfactory. The introduction of automation and mechanization to industrial production is based mainly on the import of machines and equipment (combined with the import of licenses or independently), and not on Polish engineering.

Of 120,000 machining stations in the machines industry, only 17,000 are automated. Poland does not yet produce sufficient amounts of technological equipment for highly automated production processes. The situation in the production of means of transport, equipment for assembly work, and for warehousing, is the same. Despite the fact that modern licenses have been purchased, production of industrial robots, necessary for automation in the processing industry and used in industrialized countries, has not yet been begun.

Another instrument for measuring the engineering and technological gap are the differences in the labor-, materials, and energy-intensiveness of the national income.

An especially serious gap appears in some subsectors of the electronic industry and in the chemical industry. It is caused mainly by lack of sufficient domestic materials and lack of access to modern subassemblies, equipment and apparatus.

Despite the unquestionable, in the 1970's, acceleration of technical progess in the main branches of industry, the local policy of the subsector management offices led to a deterioration of the structure and level of engineering production. This pertains especially to such branches as metallurgy, chemistry and construction. The unusually high investment outlays in these branches of industry were used mostly to create an often excessive potential in simple and low-processed materials and products. The shortage of raw and other materials for the production of high-class materials continued.

Under these circumstances, it was necessary to import goods, mainly for licensed production, causing a great dependency on the West. Bad investment decisions made this situation worse.

Since the turn of the 1970's, the flow of scientific and technical information from other countries has come to a complete halt and the flow of information and data on world scientific and technical achievements to our scientific-research facilities has decreased. This has had an adverse effect on scientific and technical progress.

The opening of Poland to the West reached its highest level in 1976, when the share of capitalist countries in foreign-trade turnovers, calculated in fixed prices, was 56 percent. In the years that followed, this share shrunk greatly and in 1981 it amounted to scarcely 44.6 percent, i.e., less than in 1970.

Poland's involvement in the international division of labor also decreased. The ratio of import to national income, which in 1976 was 34.8 percent, fell to 27.5 percent in 1981. The relationship of export to national income, which was approximately 27 percent in 1972-1978, dropped to 26 percent in 1980-1981.

The reasons for both these tendencies was the low productivity of the Polish economy and the particularly low export productivity. The inefficiency of our economy and the restrictions applied by the West made it necessaary to reasses foreign-trade policy and its role.

Analysis of 1981 and 1983 data shows that the ability of our economy, particularly the processing industry, to make the necessary conversion, is limited. To conduct a policy of economic reorientation, Poland needs capital, engineering and technology, and raw and other materials for production. There is no surplus of any of these factors in the socialist countries.

It is obvious, therefore, that without the renewal of economic cooperation with the developed capitalist countries it will be difficult to come out of the depression in which the Polish economy finds itself. It is well to remember that in expanding trade with the West, we will also be a more attractive partner for the socialist countries.

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